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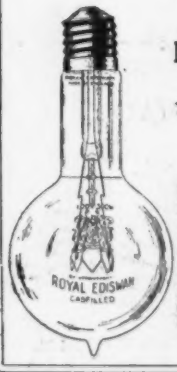

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THE

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THE ELECTRICITY DISTRICT INQUIRIES.

AT a recent company meeting, Mr. George Balfour, M.P., gave a staggering figure for the cost of the inquiry which took place at Liverpool in January; he said he had ascertained that this amounted to not less than £40,000. Up to the present the inquiries have been very unpromising, and it seems that the matter demands very serious consideration, in view of the large number of inquiries that are pending. In the House of Commons the question is being pressed whether the holding of further inquiries, and the consequently large expenditures, should not be postponed. This follows on a previous question asking why the Electricity Commissioners are holding local inquiries to consider schemes for the formation of Joint Electricity Authorities, seeing that there is no power to finance such authorities at present. This question of finance depends, we are told, on the Electricity (Supply) (No. 2) Bill being passed. The introduction of the Bill has been postponed, and there are rumours that this is a preliminary to quietly shelving it. In any case, every month that passes is likely to make the passage of a finance Bill of this kind more difficult. At this time, when the need of economy in all directions is so apparent, it seems difficult to justify the holding of inquiries costing £40,000, when their outcome is contingent upon the passage of a somewhat controversial Bill which the Government has apparently shelved at least for a time.

Whilst our leaderette last week was being printed, Mr. Ll. B. Atkinson, at the annual dinner of the Institution, was likewise deploring the unsatisfactory outlook consequent upon the inquiries which have been held, and which reveal so little evidence of that spirit of willing co-operation on the part of corporations, companies, and consumers, which is essential to the success of the national scheme for the development of electricity supply. He, also, pointed out that the schemes put forward would not carry conviction to the minds of the financial experts upon whose collaboration the whole structure must eventually be based. If we err, then, we err in excellent company when we take a somewhat gloomy view of the future of the system of Joint Electricity Authorities as generally understood. We pointed out, over a year ago, that the opportunity had been afforded to the existing authorities to demonstrate their good faith and to carry the proposals of the Act to a successful issue by hearty co-operation for the national welfare—failing that, compulsory powers would inevitably be conferred upon the Electricity Commissioners; Sir John Snell, in December last, repeated that warning, as we reported in our issue of December 24th, 1920, and this fact was also very seriously emphasised by Mr. Atkinson last week.

Obviously, to continue holding inquiries at a cost of £40,000 a week (and be it noted that the Liverpool inquiry was adjourned, and was reopened on Tuesday last, to cost, perhaps, another £40,000) would be the height of folly unless very valuable results were obtained; so far there has been no such return for the extravagant outlay, unless the writing on the wall be an adequate return—the ominous warning that the scheme has been numbered, weighed, and found wanting, and that the kingdom is to be divided *compul-*

sorily! No; if the object cannot be attained in this way, the sooner we cut our losses and find another way, the better. One inquiry has been completed—and the Commissioners will have a difficult task to formulate a rational decision on the evidence that has been laid before them. One is still in progress, and another has been begun and promptly deferred *sine die*. And time is flying.

In December, 1919, the epoch-making Act was passed, and we surmised that the promised amending Bill would not be brought forward until the Commissioners had had time to explore the situation; we were partly right and partly wrong, for it was introduced and dropped; introduced again, shorn of its most contentious clauses, and shelved—anyhow, no legislative progress has been made since 1919, and even if the Joint Electricity Authorities are brought into existence, they will be powerless until the Act is amended and supplemented by further legislation. After a lapse of 14 months, the first inquiry was opened. In the meantime, with a few notable exceptions, the hands of supply authorities have been tied, would-be consumers are clamouring for service, unemployment is increasing, and the electrical millennium seems as far away as ever. The electrification even of suburban railways has been similarly held up by the uncertainty as to the future of our railway system due to Government control, and more recently fresh disturbances have been created by the sudden resolve of the Government to abandon control. All these factors tend to depress the electrical industry and, still more, the industries which it serves. It seems inevitable that whatever the Government lays its hand on is paralysed from that moment.

We have consistently objected to the nationalisation of our industries and public services; with the object lesson of the telegraphs before us, we issued many warnings as to the consequences of nationalising the telephone service, and we have similarly opposed the nationalisation of electricity supply. The alternative that we have advocated to the latter is development by companies under public control, a system which has worked most admirably in the United States and elsewhere, and which can be made absolutely safe if undue exploitation is feared. Incidentally, we have seen no evidence that the public interests have suffered from the operations of the North-East Coast companies, the one example of almost unfettered development that this country can show—successful, in spite of their being deprived of the right to supply in many parts of their area; and there no public control has been in force. But we fully approve of the provision of such control in some suitable form.

Now that the Joint Electricity Authority inquiries are failing to "produce the goods," we turn again to this system as the most hopeful way of escape from the threatened *impasse*.

We have before us a most illuminating case to illustrate our argument—the report of the Committee appointed by the Conference of Local Authorities of the West Riding Electricity District, a Committee of eight electrical engineers to local authorities which are statutory undertakers, appointed to prepare a draft scheme for submission to the Electricity Commissioners. We give an abstract of the report elsewhere in this issue. (In passing, we note that of the 17 authorities concerned, only ten voted in favour of the resolution advocating that the Authority should consist of elected public representatives—*i.e.*, excluding companies—and that the local authorities should accept the financial responsibility entailed.)

This committee agreed that the formation of a Joint Electricity Authority was essential, and that it must possess full owning and operative powers. Immediately the committee came up against the fact that the only alternative to this policy was to appoint the Yorkshire Electric Power Co. to be the Authority. With the candour of the engineer, unbiased by political considerations, the committee says: "From an engineering point of view this should prove a most satisfactory arrangement"—and it goes on to say that the company already possesses the necessary powers for almost the whole of the district, and a considerable network of mains in existence. If the Electricity (Supply) (No. 2) Bill became law, as we pointed out some months ago, a Joint Electricity Authority could delegate its powers to the company, and would then become an advisory body, while the company would be the operative body. This is the arrangement preferred by the Committee; moreover, the possibility of representation of the local authorities on the directorate of the company in consideration of financial support is regarded with favour by the committee, which concludes that such proposals would be "sound from an engineering standpoint." Thus it satisfies its collective engineering conscience—and we heartily endorse the scheme outlined, every item in which has been advocated in our columns.

But "right here" the politician butts in; the committee recognises that "the principle of the control of public utility undertakings by local authorities has obtained firm root in Yorkshire," and proceeds to demolish the scheme which it has characterised as "sound from an engineering standpoint." It points out that the existence of the Power Co. is an insuperable obstacle to the operations of a Joint Electricity Authority, owing to the rights which Parliament has conferred upon it in perpetuity, the duplication of mains that would be necessary, &c., and concludes that if a Joint Electricity Authority is established, it must have the whole of the main transmission system in its hands. After studying the possibility of representation of the Power Co. on the Authority, and finding that such an arrangement might confer upon the company a still stronger hold on the district, the committee concludes that the only possible solution is the purchase of the company's whole undertaking and rights, necessarily by negotiation. An inquiry as to its views elicited from the company the natural reply that as there was no body in existence to treat with, it could not discuss the sale of the portion of its undertaking concerned, and the committee was left to draw the optimistic inference that if such a body were constituted the company would be willing to consider the proposition—a view for which we find no basis in the company's reply.

That is where the matter stands at present. We have dealt with it fully because it is typical of the circumstances in numerous other cases, and the point which we wish to emphasise is this: That this committee of electrical engineers managing supply undertakings (including those of Bradford, Huddersfield, and Leeds) deliberately states that the best engineering solution of the problem is to entrust the whole business to the hands of the existing Power Co., which already possesses the necessary powers, and to appoint a Joint Electricity Authority without operative powers, to act in an advisory and supervisory capacity. A very similar proposition was put forward at Llandudno by the North Wales Power Co. It is a solution which we fully approve; it would make for efficiency and economy, and would ensure the safeguarding of the public interests together with the quickest possible progress. It would obviate the necessity for holding inquiries at fabulous expense, and would enable the engineers to go ahead at once (the Yorkshire Power Co., for instance, has important developments in hand, which are held up purely by the operation of the 1919 Act, just as were those of the County of London Co.). Financial difficulties would at once disappear—the inquiries have shown how nebulous are the ideas of the promoters of Joint Electricity Authorities on this most important subject, whereas the companies can find the money without delay.

The position of such municipal undertakings as those of Manchester and Glasgow, which, like many others of importance, have proved highly successful, would call for special treatment. We see no reason why they should not continue to develop on the present lines, becoming in effect the power companies for the immediately adjoining areas.

As we go to press we learn from our special correspondent at Liverpool that, directly the Mersey and West Lancashire District Inquiry was reopened on Tuesday, the representatives of two important municipalities announced the withdrawal of their support from the main scheme, and deprecated the formation of a Joint Electricity Authority. This announcement confirms and strengthens the views that we have set forth above.

State-aided Industrial Research.

The criticism which has for some time past been levelled at the Department of Scientific and Industrial Research, that its grants to industrial research associations result in commercial firms being subsidised by the State, was revived by the report of the Development Commission, which was published recently. The Development Commission has now been in existence for some ten years, and when constituted by Mr. Lloyd George, then Chancellor of the Exchequer, was granted nearly £3,000,000, to be employed in stimulating the economic development of the United Kingdom, with special reference to certain industries, such as agriculture, forestry, and fisheries. The important point, however, to which we wish to draw attention is that the Act of Parliament constituting the Development Fund stipulated against giving advances to an association of persons or a company trading for profit, and we are told that the Commissioners have interpreted the stipulation in the strictest sense. Having regard to the fact that the work of the Development Commissioners deals largely with research, it is impossible not to contrast the terms of its constitution with the policy adopted by the Department of Scientific and Industrial Research, of definitely fostering the establishment of industrial research associations, the funds of which are provided partly by the State and partly by the particular industry.

This matter can be looked at from several points of view. In the first place, the underlying principle of the formation of research associations under the Department of Scientific and Industrial Research was that every firm engaged in a particular trade should join the association, and by its contribution towards the funds, benefit by the industrial research work which it carried out, with State assistance. Literally, of course, this would imply that the State was providing money to enable commercial firms so to improve their processes that they could make greater profits, although, alternatively, the argument can be used that the result of this State-assisted research work ought to mean improved working processes, and necessarily a reduction in the price of the particular commodity as supplied to the public. Whether the one or the other of these hypotheses has been given practical effect by the policy of the Department of Scientific and Industrial Research with regard to industrial research associations it may, perhaps, fairly be argued that it is too early to form a judgment. On the other hand, there is the point of view of the firm which, for reasons satisfactory, at any rate, to itself, does not see fit to join the Industrial Research Association. One of the terms of the formation of industrial research associations is that the results of any research work are to be the property of the contributing firms, although other firms in the industry not associated can obtain the results by paying for them.

The original idea of the Industrial Research Associations was, in the first place, to co-ordinate research, and at the same time to make available to all members of a particular industry results which could only otherwise be obtained by much overlapping and unnecessary repetition, leaving it to individual firms, even though members of the Association, to make special investigations of particular interest to themselves in their own way. The terms of the grants made by the Department to industrial research associations are that they shall continue for five years on a £1 for £1 basis, *i.e.*, that for every £1 provided by the industry the Department shall provide a similar amount, although in at least one case the Department has provided £3 for £1, that being the glass industry. What the position will be at the end of this five years it it not possible to say, but the critics of State aid of this character cannot be sure of having things all their own way, because we notice that the Development Commissioners have asked for a modification of the Act of Parliament under which they work which will enable them to proceed on more or less similar lines to the Department of Scientific and Industrial Research. It seems to us that the real test of the matter is a public one, because all members of a particular industry can obtain the results of the work of their research association, whether they belong to the association or not. On that point there can be no cause for complaint, and the real justification for the continuance of State-aided industrial research is the production of higher quality articles at lower prices to the public.

The Poulsen Patent.

The application for the prolongation of the Poulsen patent, of which the hearing and judgment are recorded elsewhere in this issue, awakens mental echoes of the turbulent days through which the art of wireless telegraphy was made to pass before the war. Then the owners of the patent were moving heaven and earth to secure a share in the projected Imperial wireless chain, and the system was prominent in the Parliamentary question list, and in the proceedings of the Select Committee of Inquiry into the Post Office contract with the Marconi Co. But the Poulsen interests failed to attain their goal. The war broke out, commercial wireless development abruptly ceased, and all efforts were concentrated on meeting the requirements of the Naval and Military authorities; both the Marconi and the Poulsen systems were used, some remarkable long-distance "circuits" being carried out with the latter, and other methods of generating continuous waves were also employed. The Poulsen patent expired in 1917, and since then the British Post Office has adopted the system for some of its long-distance stations; it is also being used on some of the big ocean liners, and has, in fact, acquired a new lease of life since the death of the patent.

The patent rights passed through an extraordinary series of adventures during their existence; we need not follow their vicissitudes—suffice it to say that they finally came into the possession of the Marconi Co., which undertook a liability of £150,000 in respect of them, and thus acquired for a brief interval a virtual monopoly of long-distance wireless telegraphy in this country. Naturally the owners sought to revive that monopoly, and lodged an application for the extension of the patent. Mr. Justice Sargant, however, had no difficulty in making up his mind on the matter; he pointed out that the war had not prevented the owners of the patent from securing capital (per the Marconi Co.), and that it had brought them much business from Government departments—hence he did not even call upon the opponents to state their case. He remarked rather caustically that it was strange that an application should be made for compensation for loss due to the war on behalf of a company which only came into existence during the war, and that even if the life of the patent were prolonged to the utmost, it would extend only to July, 1922, so that it would harass those who had made use of the system since the death of the patent, without much prospect of benefiting anyone.

We cannot but approve of his decision, which appears to accord with common sense. The way is now clear for salutary competition between the various existing systems to come into play. There is plenty of scope for them all, and progress will be accelerated by the spur of necessity.

D

THE INFLUENCE OF TRANSFORMER CONNECTIONS ON THIRD HARMONIC VOLTAGES & CURRENTS.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

It is the purpose of this article first to enunciate briefly the fundamental principles of third harmonic voltages and currents in symmetrical three-phase systems; secondly, to indicate their origin purely in respect of transformers; thirdly, to marshal the facts and present them in tabular form, and finally to indicate their objectionable features.

It is not claimed that any new theories are introduced in the article, but simply that facts, often understood in a more or less vague sort of way, are here crystallised and presented in a clear manner.

Principles of Third Harmonics in Symmetrical Three-phase Systems.

There are two general forms of connections of three-phase systems to be treated of:—

(*a*) Star connection.

(*b*) Delta connection.

(*a*) *Star.*—In any star-connected system of conductors it is a basic law that the instantaneous sum of the currents flowing to and from the common junction or star point is zero.

In a symmetrical three-phase, three-wire star-connected system the currents and voltages of each phase at fundamental frequency are spaced 120 deg. apart, and at any instant the current in the heavier loaded (instantaneously) phase is equal and opposite in direction to the sum of the currents in the other two phases, and at fundamental frequency this balance is maintained throughout the cycle. At third harmonic frequency, however, currents flowing in each phase would be $3 \times 120 = 360$ deg. apart, or, in other words, in phase with one another and flowing in the same relative direction in the phases at the same instant. The sum

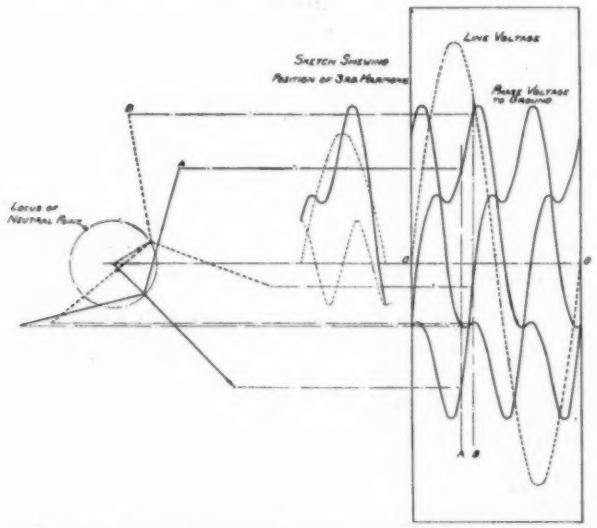


Fig. 1.—Phenomenon of "Oscillating Neutral" in a Symmetrical Three-phase, Three-wire, Star-connected System, with unearthed neutral.

of the currents in the star connection would, therefore, not be zero, and consequently in a symmetrical three-phase, three-wire star-connected system, third harmonic currents cannot exist.

If, however, a connection is taken from the neutral point in such a manner that it completes the circuit of each phase independently (though through a common connection), a current at three times the fundamental frequency can circulate through each phase winding and through the line wires and the fourth wire from the neutral point. The fourth wire acting as a drain for third harmonic currents preserves the current balance of the system; it has, of course, no effect on the currents at fundamental frequency as these are already balanced.

Third harmonic voltages, on the other hand, can exist in each phase of a symmetrical three-phase, three-wire star-connected system, that is, from each line wire to ground,* but they cannot appear in the voltages between lines. The third harmonic voltages in each phase are in phase with one another so that there is one third harmonic vector only, and the neutral point of the star is located at the end of this vector. The potential of the neutral point is consequently not zero, but oscillates round the zero point at triple frequency and third harmonic voltage. Fig. 1 † illustrates this phenomenon

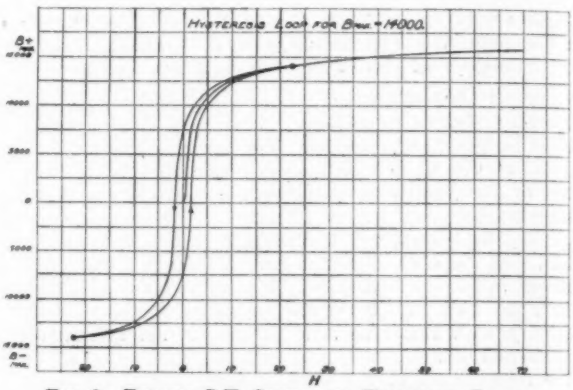


Fig. 2.—Typical B.H. Curve and Hysteresis Loop for Transformer Sheet Steel Core Plates.

and also shows how the third harmonic voltages to ground cancel out, so far as the voltages between lines are concerned, leaving the line terminal voltages free from their influence.

When a connection is taken from the neutral point in such a manner as to allow third harmonic currents to flow, the third harmonic voltages to neutral are expended in forcing the currents round the circuits. It will be seen subsequently that according to the characteristics of the circuit in which these currents flow, the third harmonic voltages may be totally or only partially suppressed.

(*b*) *Delta.*—In any delta-connected system of conductors it is a basic law that the resultant fundamental voltage round a mesh is zero. That is, the addition of the voltage vectors at fundamental frequency which are spaced $360 \div m$ (where m = number of phases) degrees apart forms a regular closed polygon.

In a symmetrical three-phase delta-connected system third harmonic voltages tending to occur in each phase would be spaced 360 deg. apart, and so would be in phase with each other and act in the closed delta circuit as a single-phase voltage of third harmonic frequency. Such a voltage could not actually exist in a closed delta system so that third harmonic currents circulate round the delta without appearing in the line wires, and the third harmonic voltages are suppressed.

In discussing the third harmonic aspect of various combinations of star and delta connections for three-phase transformer operation we therefore have the following bases to work upon:—

1. With a three-wire star connection third harmonic voltages may exist between lines and neutral or ground, but not between lines.

2. With a three-wire star connection third harmonic currents cannot exist.

* With unearthed neutral, or from each line wire to neutral with earthed neutral. See appendix.

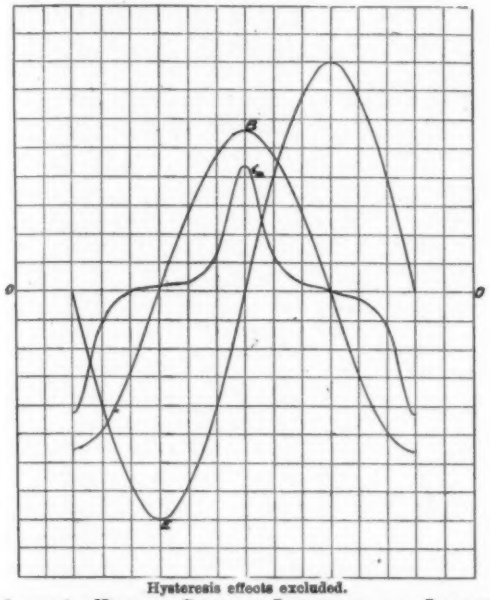
† Taken from a paper by J. F. Peters, "Harmonics in Transformer Magnetising Currents." *Procs.* A.I.E.E., 1915, p. 2,157.

3. With a four-wire star connection third harmonic voltages from lines to neutral or ground are partially or completely suppressed, according to the impedance of the third harmonic circuit.

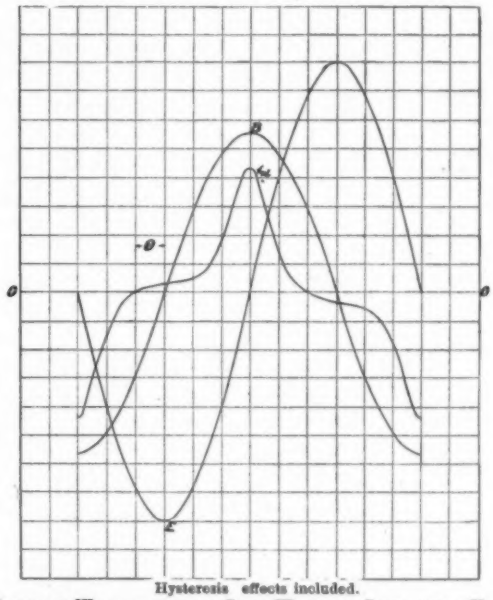
4. With a four-wire star connection third harmonic currents may flow through the phases and through the line wires and fourth wire from the neutral.

5. With a three-wire delta connection third harmonic voltages in the phases and hence between the lines are suppressed.

6. With a three-wire delta connection a third harmonic current may flow round the closed delta, but not in the lines.



Hysteresis effects excluded.



Hysteresis effects included.

Figs. 3 and 4.—No load Current, Induction, and Induced Voltage Waves, with a Sine Wave of Impressed Voltage.

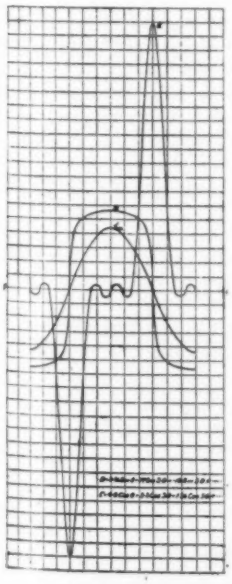
Origin of Third Harmonic Voltages and Currents in Transformers.

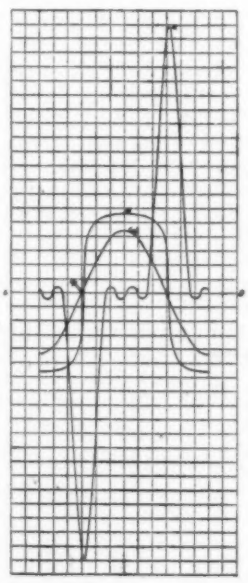
It should be understood that this discussion is quite distinct and apart from higher harmonic functions of the source of supply, and it is limited to those which are inherent in the magnetic and electric circuits of the transformer. The two circuits being closely interlinked, it is a natural sequel that the higher harmonic phenomena occurring in both should be interdependent.

It is well known that there are two characteristics in the behaviour of sheet steel transformer plates when under the influence of an alternating electro-magnetic field, which produce an appreciable distortion in the wave form (from the standard sine wave) of certain alternating functions. These functions are magnetising (or more truly no load) current, flux, and induced voltages, the distortion of which severally, or together, is due to the varying permeability of the sheet steel plates and to cyclic magnetic hysteresis. For the purpose of this article the range of the phenomena involved is more briefly and cogently explained by means of diagrams with short explanations than by lengthy dissertation and tedious mathematical equations; figs. 2 to 7 inclusive, together with the following remarks, aim at attaining this end.

Fig. 2 shows an average B.H. curve with hysteresis loop for modern silicon steel transformer plates; the hysteresis loop shown corresponds to a maximum induction of 14,000 lines per square centimetre. This figure is intentionally taken high in order to magnify the harmonic phenomena.

Fig. 3 shows the wave form relation between the no-





Hysteresis effects excluded. Hysteresis effects included.

Figs. 5 & 6.—No-load Current, Induction, and Induced-Voltage Waves with a Sine Wave of No-Load Current.

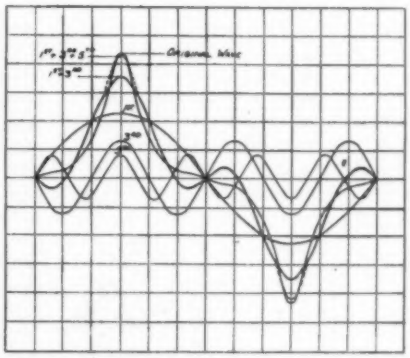


Fig. 7a.—Harmonic analysis of Peaked No-Load Current Wave of Fig. 3.

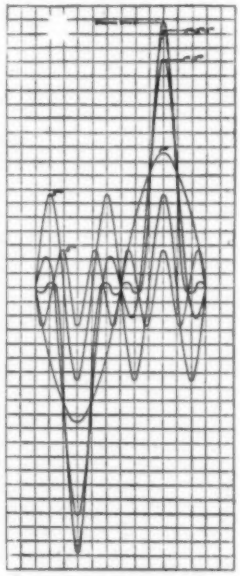


Fig. 7b.—Harmonic Analysis of Peaked Induced-Voltage Wave of Fig. 5.

load current, flux, and induced e.m.f. when the e.m.f. is a sine wave and when hysteresis is absent. From a study of these curves it will be seen that the current is a true magnetising current, being in phase with the flux, its peaked form showing the presence of a prominent third harmonic. It will also be noted that this wave is symmetrical about the horizontal axis, and each half wave about a vertical axis. The flux must, of course, be sinusoidal on account of the assumption of a sine wave induced e.m.f.

Fig. 4 is similar to fig. 3, with the exception that hysteresis is taken into account. In this case the current is not a true magnetising current on account of the hysteresis component which is introduced, which makes the no-load current lead the flux by a certain angle θ, the hysteretic angle of advance. This figure also shows that for the same maximum induction the

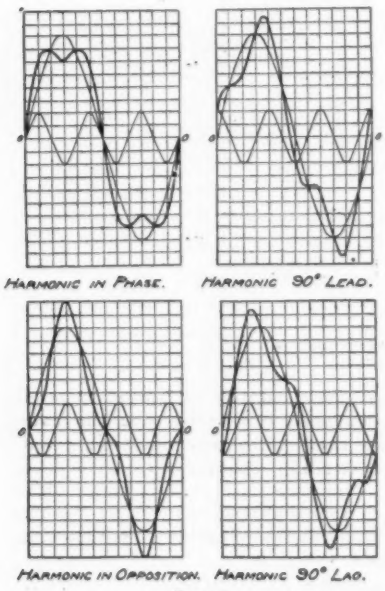


Fig. 8.

Combination of Fundamental and Third Harmonic Waves.

maximum values of the true magnetising and no-load currents are the same, but that when taking hysteresis into account the no-load current becomes unsymmetrical about a vertical axis passing through its peak. It will, however, be seen by comparing figs. 3 and 4 that the third harmonic component is contained almost entirely in the true magnetising current, and very little, if any, in the current component due to hysteresis, thus indicating that third harmonic currents are produced as a result of the varying permeability of the sheet steel plates, and only in a very minor degree by magnetic hysteresis.

Fig. 5 shows the wave form relation between the no-load current, flux, and induced e.m.f. when the current is a sine wave and when hysteresis is absent. As in the case of fig. 3 the current is a true magnetising current and in phase with the flux. The flux wave is flat topped which indicates the presence of a third harmonic in phase with the fundamental, the harmonic having a negative maximum coincident with the positive maximum of the fundamental, and so producing a flat-topped resultant wave. It will be noticed that the flux wave is symmetrical about the horizontal axis and each half wave about a vertical axis. The induced e.m.f. is, of course, affected by the departure of the shape of the flux wave from the sine, a flat-topped flux wave producing a highly peaked wave of induced e.m.f. (as shown in the figure) in which also appears a prominent third harmonic. In the case of the voltage wave the third harmonic is in opposition to the fundamental, the positive maximum of fundamental and harmonic waves occurring at the same instant, so that the resultant voltage wave becomes peaked.

Fig 6 is similar to fig. 5, with the exception that hysteresis is taken into account. In this case the no-load current leads the flux, thereby producing the hysteretic angle of advance θ as in the case of fig. 4. The flux wave is somewhat more flat topped, and while still symmetrical about the horizontal axis, each half wave is unsymmetrical about a vertical axis passing through its peak.

Hysteresis does not alter the maximum value of the flux wave, though it increases its dis-symmetry; the wider the hysteresis loop the greater the dis-symmetry of the flux wave.

Fig. 7 shows the analysis up to the fifth harmonic of (*a*) the magnetising current wave $_m$, fig. 3, and (*b*) the induced voltage wave E, fig. 5; in each case waves are given showing the sum of the fundamental and third harmonic, and indicating the degree of the error involved in ignoring harmonics beyond the third.

In order to obtain some idea at a glance as to the approximate phase of the third harmonic relative to the fundamental in a composite wave, fig. 8 is given

TABLE I.

Constant B max.

Flux.			Induced Voltage		No Load Current.	
Wave Shape	Form Factor Compared To Sine Wave.	Iron Loss Compared To That With Sine Wave Flux	Wave Shape	Form Factor Compared To Sine Wave	Wave Shape	Form Factor Compared To Sine Wave.
Sine.	Same	Same	Sine.	Same	Peaked. Third Harmonic in Opposition.	>
Flat. Third > ½ Harmonic in Phase	<	Same	Peaked. Third < ½ Harmonic in Opposition	>	Sine.	Same
Constant E eff.						
Sine.	Same	Same	Sine.	Same	Peaked. Third Harmonic in Opposition	>
Flat. Third > ½ Harmonic in Phase	<	>	Peaked. Third Harmonic in Opposition	>	Sine.	Same

Wave-shape relationship between flux, induced voltages and no-load current.

showing the shape of the resultant waves obtained when combining the fundamental and third harmonic alone with different positions of the harmonic.

From the foregoing discussion on the origin of third harmonics the following conclusions are to be drawn:—

1. With a sine wave of flux, and consequently induced voltages, the no-load current contains a prominent third harmonic which produces a peakiness in the wave. The third harmonic is introduced mainly into the true magnetising current component through the variation in the permeability of the sheet steel and only in a very small degree into the hysteresis component of the current by the cyclic hysteresis.

2. With a sine wave of no-load current the flux and consequently the induced voltages contain prominent third harmonics which produce a flat-topped flux wave and peaked induced voltage waves.

Table I summarises the above conclusions (*a*) for constant B maximum; (*b*) for constant E eff.

(To be continued.)

An Electrically-Welding Motor Repair Boat.—There was recently completed at Gothenburg a small motor tug and repair boat named *Esab IV.* constructed by the Svetsnings Aktiebolaget, for the firm's own use. She is 52 ft. 6 in. in length, with a beam of 13 ft. 1½ in., and is fitted with a semi-Diesel engine for propulsion, in addition to semi-Diesel-engine-driven welding generating sets. The boat is used both as a tug and as a repair boat, the object being for it to proceed to vessels lying at anchor requiring welding work to be carried out on them. All the necessary equipment for the purpose is carried on *Esab IV.*—*Motor Ship.*

THE PRICE OF COAL IN RELATION TO ITS HEAT VALUE.

By J. S. EVENDEN.

The de-control of the mining industry, and the resultant de-control of prices, are matters of such importance to the coal consumer that they should command the closest possible attention, particularly in view of the many anomalies which have been permitted to exist for some time past. It will be generally admitted that the purchase of coal upon the basis of its heat value should be the aim of all large consumers, and concerted action on their part would tend towards the realisation of this ideal, but this action must not be confined to mere destructive criticism, its object should be the enlightenment of the colliery owners as to the real requirements of the consumers and the many disadvantages which are inseparably associated with the existing practice of charging for fuel by gross weight alone. This system, it is needless to say, will continue so long as it is passively accepted as inevitable by the consumer.

Those who have studied the publications of the United States Government relating to the preparation, purchase, storage, and utilisation of coal and allied subjects, and at the same time have had experience as large consumers in the United Kingdom, will have no doubt as to the urgent need for reform or the possibility of effecting a marked improvement upon our present methods.

At the time of writing (January, 1921) a comparison between the prices charged for several typical grades of coal shows some extraordinary vagaries, the following examples being sufficient to illustrate how the consumer is affected. These examples were not specially selected, but were taken at random and based upon a list of current prices f.o.r. London, and they are sufficient to show that there is at present no fixed relation between the price and the quality of coal.

	Calorific value (as received). B.th.u.	Cost per pound of ash-free d·y coal. Penny.
Monmouthshire nuts	14,250	.313
Yorkshire washed doubles ...	12,800	.287
Nottinghamshire D.S. nuts ...	11,390	.293
Nottinghamshire nutty slack	10,500	.303
Derbyshire D.S. nuts	11,880	.317
Derbyshire nutty slack ...	10,400	.328
Derbyshire fine slack	9,300	.328
Leicestershire nutty slack ...	9,800	.315

It is surprising to observe from these figures that Yorkshire washed doubles and Monmouthshire nuts of high calorific value show an appreciably lower cost per pound of combustible than Derbyshire fine slack or Leicestershire nutty slack of very poor quality. Now it will be generally conceded that, in most power plants, a high average efficiency will be most easily maintained with good coal, while the most careful and continuous supervision is essential if good results are to be obtained with low-grade slacks. Therefore, it follows that, under prevailing conditions, the user of the latter class of fuel is subjected to a dual penalty, inasmuch as he has, in many instances, to pay more for his combustible (ash-free, dry coal), and has to spend more money in order to secure efficient combustion, and to pay for the handling and removal of an excessive quantity of incombustible residue. This is, of course, contrary to what would naturally be expected as a reduced cost per pound of combustible is necessary to compensate for the disadvantages which attend the use of low-grade fuel, and make its acceptance a commercially attractive proposition.

An important step towards the standardisation and equitable assessment of coal values would be made if washing and grading could be extended. With the exception of extremely poor coal, it would appear desirable that the whole output should be graded throughout down to peas so that only fine slack or slurry would remain as residue. The pre-war standard of care in mining, and the hand-picking of shale, &c., might well be restored, and every effort made to reduce the incombustible content as nearly as possible to the intrinsic ash contained in, and impossible to remove from, the coal.

It should be appreciated by the suppliers that consistency in quality and physical characteristics is of paramount importance to the consumer as, particularly in the case of coal used for steam boiler furnaces, such consistency tends to stabilise furnace conditions, and thus forms a valuable basis for efficient combustion.

It is, of course, appreciated that the war period imposed grave and far-reaching restrictions upon the mining industry and that, subsequently, industrial and other difficulties have rendered developments and improvements almost impossible, but the time is now approaching when the consumer will look for better service and, to no small extent, he has the power to secure it.

The recently legalised method of charging for gas by the therm (100,000 B.th.u.) would appear to afford a very suitable basis for the valuation and sale of coal. A standard pit-head charge per therm could be set up which might form the basis of a compensating scale to meet the variable factors attributable to the presence of excessive moisture and/or ash in certain grades. In other words, a premium would have to be added to the price per therm for good coal or a reduction made in the case of low-grade fuels.

The fixing of these charges could be made the business of a carefully selected committee representing the coal owners, the Government, and the consumers, and, when once established, it would do away with the anomalies already referred to in this and a previous article. Such a charge would, of course, be subject to the variations which changing industrial or market conditions might render advisable, just as the price per ton is now varied, from time to time, for similar reasons.

At the same time, it would be necessary to organise and make compulsory the continuous sampling and testing, at the pits, of each and every grade produced. This testing and sampling would need to be carried out in strict accordance with standard methods laid down by a small committee of experts appointed for the purpose, otherwise there would most certainly be an unfortunate lack of uniformity and, what is almost equally certain, the supreme importance of the utmost care in sampling, upon which the reliability and value of coal testing depends, would be overlooked.

When once this organisation had been established, it would become customary, if not compulsory, for the seller to supply the consumer with test results and definite guarantees relating to all coal supplied, the following being a rough suggestion as to the form which such an ideal guarantee might assume:—

Guarantee as to Class and Quality of Coal Invoiced.

The coal invoiced hereon was mined from the..... seam of the.....pit at.....Colliery in the County of..... It consists exclusively of freshly mined coal in the form of.....nuts made through a screen of.....and passed over a screen of.....

The average of our daily tests on this identical class and grade of coal for the week ended..... gave the following results.

Calorific value (dry).....B.th.u.
Ash (as received).....per cent.
Volatile matter (as received).....per cent.
Moisture.....per cent.

and we hereby guarantee that the coal now supplied is equal in average value to the above.

Certain modifications would, of course, be necessary in order to adapt this form to the many classes of coal which are marketed for various purposes, but it is safe

to say that some such guarantee would induce, if not compel, the seller to take a far greater interest in the quality of coal sent out, and would be extremely beneficial to the consumer. It will doubtless be said that the work of testing and furnishing results and guarantees would be a somewhat costly matter, but although this may be so, the expense would be very small in relation to the cost of production; moreover, it may surely be claimed that it is, and always has been, the obvious responsibility of the seller to take some really practical interest in the value of his output and be prepared to furnish to the purchaser a reliable guarantee as to quality and class of coal supplied, and the source from whence it was derived.

From the consumers' point of view there can be nothing but advantage in buying coal upon a thermal basis under strict guarantees, assuming, of course, that the methods of testing adopted by the collieries are of a proper character, the tests regularly conducted by experienced men, and liable to inspection at any time by Government inspectors. Moreover, the large consumers would naturally continue to carry out their own tests, and these would constitute a very valuable inducement to the colliery owners to see that their own testing was done in a proper manner and reliable figures furnished to their customers.

To the small consumer who cannot very well undertake his own testing the information provided by the suppliers would be most valuable, enabling him to ascertain the efficiency of his plant and generally increasing his interest in the all-important question of coal economy, which, even if it makes no appeal to the colliery owner, is of very great national interest.

Further, the very fact of selling coal by the therm instead of by weight, would have a beneficial effect upon the all-round quality of coal sent out, as it would no longer be desirable to permit an undue proportion of incombustible matter to leave the collieries, whereas, at the present time, it is obviously to the advantage of the seller to work in as much rubbish as the consumer will tolerate. In fact it seems as unreasonable to permit the sale of coal, free from all legal restrictions and requirements as to quality, as it would be to permit the supply of gas without any stipulation as to calorific value, illuminating power or pressure.

In this rapid survey of a big problem, the many difficulties to be surmounted and the conflicting interests involved have not been overlooked, and are fully appreciated, but it is confidently believed that, given the assistance of men possessing the necessary knowledge and experience, and having as their single objective the establishment of a more equitable and sensible method of preparing, distributing, and selling coal, the difficulties to be faced, although formidable, could most certainly be overcome. That this is a consummation much desired by the consumer does not seem open to question, but action upon his part appears to be necessary if it is to be brought about.

MOTOR-HOUSE LIGHTING FROM A CAR.

By "VOLTMAN."

The importance of having a good working illumination in a private motor-house requires no emphasising. If an ordinary lighting supply is already available there is, of course, no difficulty, one simply has a number of lamps placed in the required positions. To connect up specially a supply from the house and have special wiring and fittings put in is, however, nowadays so costly a matter that the ordinary motorist, with his greatly increased expenditure, has to look round for something suiting his diminished resources. The use of oil lamps is obviously attended with serious risks in view of the presence of inflammable material, and had better not be entertained. Yet it is quite a simple, and withal, inexpensive, matter to adapt the car installation to light the motor house very effectively to meet ordinary requirements, for which a general illumination suffices.

A car owner with an ordinary 12-volt equipment carried out his lighting on the following inexpensive lines:—He strung tightly two bare copper wires, No. 14 gauge, a few inches apart under the roof of the motor house which was originally a stable with the fittings removed. The wires he supported at the middle by a light wooden cross-bar or batten.

To the ends of the line nearest the door a length of lamp flexible was soldered, an ordinary pin socket contact being attached to the other end so that it could at any time be pushed into the connection provided on the switchboard of the car. Then three miniature b.c. lamp fittings with flexible, &c., were dropped at selected positions from the bare wires and the joints soldered. The usual miniature shades were not efficient, and larger and better ones were made from cardboard. In these fittings bulbs of 8 c.p., 10 volts, were inserted, thus allowing for a slight voltage drop, and the result was a very practical working light. A switch is quite unnecessary, as the socket serves the same purpose. A useful supplement to the installation is an inspection hand-lamp, having a few feet of flexible permanently connected through a switch to the line where it is brought down near the door. Usually the pin contact socket is reserved for this purpose.

In thus using current out of his battery for what is strictly an unintended purpose, it is important for the motorist to get his battery on charge as soon as he takes the car out again, otherwise he may find his lamps rather "low" at an inopportune time, particularly if the starter has to be used; this operation, of course, tends to "drain" the battery fairly rapidly. Car batteries, moreover, nowadays are of smaller capacity than formerly.

THE USES OF WOOD IN LEAD ACCUMULATORS.

By T. E. GREEN.

Wood, its treatment, and the study of its behaviour, play a much more important part in the manufacture and efficient working of lead accumulators than appears at first sight. It is used in large quantities for such important parts as the containers, stands, separators, &c., and for each part the suitability and special treatment of the wood has to be studied. That most commonly used is pitchpine, whilst a considerable quantity of teak is also used for certain special conditions. Pitchpine is a heavy resinous wood which shrinks greatly, and is rather liable to split. It is, however, cheap and plentiful. Teak is a more expensive wood, and is only used in special cases, such as for the containers of cells for use in tropical countries. It has immense durability. A comparative table of breaking weights for standard beams 1 ft. long by 1 in. sq. has been deduced by Sir John Anderson, from a close study of many experiments; the strength of teak is given as 814 lb., whilst that of pitchpine is in the region of 550 lb.

For stands for accumulators, pitchpine is usually used. It must be carefully selected, well seasoned, and free from knots, shakes, and other defects. The cells may be supported on wooden trays, which, if the cells are of the glass container type, may be filled with sawdust to take up any inequalities in the containers. The stands must be of ample dimensions for the work they have to do, and carefully made and erected, so that the weight of the battery is evenly distributed over the floor. They should receive at least three coats of acid proof paint, and should be without any metal fittings of any kind.

Wood is also often used for the containers of cells, mainly for the larger sizes, but also for portable cells and train-lighting batteries. As mentioned above, in cells intended for use in tropical countries, the wood used is usually teak, on account of its freedom from warping, even under the most extreme variation of climate. Pitchpine is the wood

generally used for the containers of large stationary cells. The wood must be carefully selected and free from any defects. The sides must be of ample dimensions to stand any stresses which may be set up from the working of the cells. The sides are usually fastened by dovetailed joints, and pinned at the corners with dowels, the latter sometimes being made of hard wood. Before the lead lining is inserted in the containers, they must be either pitched or waxed or treated with some other equally good acid proof compound. In the case of portable cells and train lighting sets, teak is used, waxed and polished with paraffin wax.

The separators are a very important part of an accumulator, and before wood can be used for this purpose it has to be chemically treated, to get rid of all the wood acids, and thus render it inert when in the cell. It is obviously necessary for the wood to be highly porous when ready for use. After treatment, the separators are kept in water, and are dispatched wet; for if they were allowed to dry, they would warp and split. The treatment by which the wood is rendered inert also makes it very weak mechanically, and it is necessary to handle the separators very carefully. This should be especially remembered if at any time it is necessary to remove them from the cell for cleaning or similar purposes. The wood separators may be either in the form of dowels or sheets. Dowels are sometimes used in stationary cells. A grid is laid on the bottom of the container, and the dowels fit into this; they are further held in position by horizontal supports along the top of the battery and at right angles to the plane of the plates. Separators in the form of sheets are often used, especially for vehicle and other portable work. They are better than the dowel type, and are practically standard practice to-day. These sheets should be fastened so as to be flush with the top of the plates, and should project $\frac{1}{4}$ in. to $\frac{1}{2}$ in. on each side and $\frac{1}{2}$ in. to 1 in. or more at the bottom. They are held in position by means of wood dowels. They are usually placed exactly midway between the positive and negative plates; in the case of grid-type negatives, they may be placed against the negative plate, but care must be taken that they are never placed against the positives. This is sometimes done by inexperienced erectors, and the result is that the free diffusion of the electrolyte is considerably interfered with, and corrosion takes place. In the case of portable cells, train-lighting sets, &c., the sections are often rested on blocks of wood placed at the bottom of the containers, the wood being first treated with paraffin wax. In large stationary cells, waxed wood is often used for packing pieces between the edges of the plates and sides of the container.

LEGAL.

Philips v. Ajax, Ltd.
An Electric Belt Claim.

In the King's Bench Division of the High Court of Ireland, Dublin, before the Master of the Rolls, in an intended action by Mr. Edward McPhilips, of Bundoran, Co. Donegal, against Ajax, Ltd., manufacturers of electric apparatus and appliances, 25, Holborn Viaduct, London, an application by the intended plaintiff to serve a writ of summons out of the jurisdiction was refused, but liberty was given to apply to the full Court.

Counsel for the plaintiff (Mr. Maguire) said the action was being brought for alleged breach of contract with respect to an electric belt or appliance supplied by the defendants to the plaintiff, who sent them a cheque for £21 in payment for it.

In an affidavit Mr. McPhilips stated that in the month of January, 1920, he saw in a Dublin newspaper an advertisement inviting the public to send to the British Electric Institute (Ajax, Ltd.), at the address mentioned, for a copy of their book on electric treatment, which, it was stated, contained a price list for electric batteries. The advertisement set out the curative properties of the electric batteries manufactured by Ajax, Ltd., and represented that they were a remedy for nervous trouble and many other disorders and ailments. He wrote for, and obtained, a copy of the book advertised, entitled "Electricity, the Road to Health," with a covering letter enclosed, explaining that Ajax, Ltd., had spent many years studying the science of electric therapeutics. Eventually Mr. McPhilips sent them a cheque for £21 for the appliance, which Mr. Maguire now stated turned out to be quite worthless. The intended plaintiff further stated in his affidavit that the action could be more conveniently tried in Ireland than in London, as all the witnesses he intended to call resided in Ireland. One of them would be an expert.

The Master of the Rolls remarked that it might cost the defendants £500 to bring their experts over to Dublin.

Mr. Maguire described the plaintiff as a man of substance, and said it would be a negation of justice if he were not allowed to issue and serve the writ out of the jurisdiction.

The Poulsen Arc Patent.
Prolongation of Patent Refused.

In the Chancery Division, on Thursday, Mr. Justice Sargant heard an application for the prolongation of letters patent No. 15,599 of 1903, granted to Valdemar Poulsen, for improvements relating to the production of alternating electric currents. The applicants were Mr. Christopher Hage, of Copenhagen; the British & Overseas Engineering Syndicate, Ltd., 4, Old Burlington Street; and the Poulsen Wireless Telegraph Co., Ltd., Marconi House, Strand. The Board of Trade, Mr. C. F. Elwell, and the Radio Communication Co., Ltd., opposed the application.

Mr. J. Hunter Gray, K.C., and Mr. Trevor Watson appeared for the applicants; the Attorney-General and Mr. Jas. Whitehead for the Board of Trade; and Mr. Courtney Terrell for Mr. Elwell and the Radio Communication Co.

Mr. Gray said the application was made under the 1919 Act. The subject of the patent was usually spoken of as the Poulsen arc. With the arc they got a continuous oscillation of equal amplitude as long as the arc was burning. Mr. Poulsen suggested and obtained the use of hydrogen or coal gas as an atmosphere in which the arc was to burn. The result was that the oscillations were of greater amplitude, and consequently they were in a position to send these disturbances over much greater distances than was possible with the arc of Mr. Duddell. Mr. Poulsen also used a strong magnetic field which broke the arc at each oscillation, and it was the combination of these two devices with the Duddell invention which was claimed in Poulsen's specification.

The Attorney-General: We do not propose to make any attack upon the validity of the patent.

His Lordship: Does that apply to the opponents also?

Mr. Terrell: Yes.

The Attorney-General: We shall have to submit to your Lordship that this is not a case within the Act of 1919, inasmuch as there has been no loss or damage suffered in consequence of the state of affairs brought about by hostilities, and it is not really a case for originating summons.

Mr. Gray said the Poulsen arc as worked to-day was a most valuable commercial and industrial invention. Unless they had the continuous wave system of transmission they could not send telephonic messages as contrasted with mere Morse signals or telegrams. He had a long affidavit by Mr. Corby, the secretary of the Poulsen Wireless Telegraph Co., and he would call Mr. Gambil, who could deal with this from his own knowledge. Mr. Hage was only the legal owner of the patent, and the British Overseas Engineering Syndicate, Ltd., were at the date of this summons the beneficial owners; the Poulsen Wireless Telegraph Co. were now under an assignment really the beneficial owners. For some years from the beginning of the life of the patent the owners apparently had not got the money or did not take the proper steps to get it pushed at that time; many approaches were made to Government bodies and other people from time to time, first of all to take up the installation of this system, and also to other people to finance it, but there seemed to be, quite properly, a great reluctance on the part of those authorities and people to venture money on a thing which at the moment had not been proved in a commercial way, especially as the Marconi system was then realised as being a commercial matter,' and was in fact used exclusively on board ships. At the time that war broke out there were altogether six stations which had been built and were worked on behalf of the Poulsen Co. under licence from the Post Office. The applicants said that if the war had not taken place they would have done a large business with the Admiralty, the War Office, the Post Office, and the India Office. They were equipped in August, 1914, to do big business, and if it had not been for the war they would have done it.

Evidence was then given by Mr. J. St. V. Pletts, who was for 20 years with the Marconi Wireless Telegraph Co., and was now an independent consulting engineer; Prof. E. W. Marchant, David Jardine Professor of Engineering of the University of Liverpool; Mr. Gambil, of the Poulsen Wireless Telegraph Co., and Mr. F. A. Walrond.

His Lordship, giving judgment, said the summons was certainly brought under very exceptional circumstances. The patent expired as long ago as July, 1917, and the originating summons was only taken out on July 5th, 1920, three years after the expiration of the patent and only two years from the utmost time to which under the provisions of the Act he could possibly extend the patent. If he granted an extension for the full term asked the only practical result would be that the patentees or applicants would get an extension from to-day till July 14th next year, and in the meantime the result would obviously be that any persons who had been working under the system in connection with the patent would find their operations hindered and jeopardised for that period of 15 months. He was deciding this on the sub-

mission by Mr. Whitehead that the evidence on behalf of the applicants was not sufficient to raise a prima facie case for extension. At the outbreak of war Mr. Hage was the sole owner of the patent. After the outbreak of war rather a complicated transaction was entered into under which the two petitioning companies came for the first time into the story: the British and Overseas Engineering Syndicate, Ltd., and the main applicants here, the Poulsen Wireless Telegraph Co., Ltd. Under the agreements that were made then, the English patents and some foreign patents were sold to the syndicate for the purpose of the syndicate reselling them to the Poulsen Co., and the syndicate, which had comparatively small capital, undertook some extraordinarily onerous obligations towards the Poulsen Co. By a deed of covenant entered into between the Marconi Co. and the Poulsen Co. the Marconi Co. undertook to fulfil the obligations of the syndicate as regards the provision of capital and so on, the result of which was that the Poulsen Co. became in a position to enforce from the Marconi Co. the provision of no less than £150,000 cash for the purpose of developing this patent. The first cause of loss that had been put forward on behalf of the applicants was that the Treasury restrictions which existed at the date when these agreements were entered into prevented the Poulsen Co. providing the capital which was necessary for the adequate exploitation of the patent. It seemed to him that it was quite plain that by reason of the practical cession of its rights to its rival, the Marconi Co., the Poulsen Co. did become in a position to command the whole of the capital necessary for the adequate development of its patents, and that therefore any loss that might otherwise have been said to be due to the Treasury restrictions was in fact not so caused. That source of loss being negatived, he had yet to deal with the loss which was alleged by reason of the company not getting such a large user of its patent as would have been the case but for the state of war. It seemed to him a curious state of circumstances that a company, not in existence before the war, should claim loss or damage by reason of the war when it only was constituted, as in this case, after the outbreak of war. He did not think that any substantial prima facie case had been made by the applicants for saying that they had had a smaller user of their patents than they would have had if the war had not broken out.

His Lordship then dealt with the user of the patent by the Government departments. As far as the Admiralty and the War Office were concerned, the evidence led him to think that there was in consequence of the war a much larger use on the part of both those Government departments than if the war had not occurred. He did not see any real reason to think that the result of the war was, as regarded general commercial uses, to interfere with any reasonable prospects of business that were enjoyed by the applicants at the date of the outbreak of the war. In his judgment, and having regard to the very strong case which had to be made by any patentee coming so long after the expiration of the patent, this was not a case in which the applicants had made a sufficient prima facie case for it to be necessary for him to call on the Crown and on the opponents of the applicants. He therefore dismissed the application with costs as towards the opponents, and of course no order as to costs in regard to the Crown.

A Cape Town Electrician Fined.

An electrician named Frank Scullard was recently charged at the Magistrates Court at Cape Town on two counts with contravention of the City Electric Lighting Regulations. The proceedings arose owing to a native having been killed by an electric shock, which was alleged to be due to defective wiring by Scullard, who had installed a light in a yard by running a flexible wire along a galvanised iron fence. The result was that the fence became alive, and the native received the shock on getting through the fence, a sheet of iron having been removed.

A fine of £5 on each charge, or three months' hard labour, was imposed.

Workmen's Compensation Claim.

(Telephone Linesman's Death.)

In the Mayor's and City of London Court, on March 7th, Mrs. Edith Farmer, 11, Redgrave Road, Putney, demanded £300 compensation under the Workmen's Compensation Act against the Postmaster-General for the death of her husband, who was a telephone linesman in the telephone department, and who met his death as the result of injuries received on February 17th of last year when he grazed his thumb, septicæmia supervening, death following on March 2nd.

Dr. Murray Leslie, the Home Office Medical Referee, sat with Judge Atherley-Jones, K.C.

Plaintiff stated that her husband complained to her that while at work on telephone subscribers' wires he scratched his thumb with a piece of copper wire. He did not pay much attention to it, but it got worse. She called in a doctor, who treated her husband for rheumatism and subsequently rheumatic fever. What he was really suffering from was septicæmia, and he was admitted to St. George's Hospital, where he died 14 days after the injury.

Mr. Gallaher, for the Postmaster-General, urged that there was no evidence to show that the deceased scratched his thumb while at his work, and there was nothing to connect his death with the accident, if there was one.

Ashby Cardrey, sectional engineer to the Post Office, who had charge of the deceased, said he worked on jointing lead covers for cables and joining subscribers' circuits, but he never complained of hurting his thumb.

Col. Prynne, D.S.O., C.B.E., F.R.C.S., chief medical officer to the Post Office, thought it improbable that the injury to the deceased's thumb caused his death.

Judge Atherley-Jones, K.C., deplored the fact that the plaintiff had had to conduct her case in person, instead of which the Postmen's Union should have looked after her. He found for the applicant for £300.

SWISS ELECTRICAL PROBLEMS.

The trend of affairs in Switzerland is of no little interest to the electrical world just now from two points of view. First, that country's progress towards normal conditions is being watched because upon it depends Switzerland's power for competition in the world's markets for electrical apparatus. Linked with that factor is the prospect of early and rapid development of the Swiss railway electrification programme, and of the capacity of that country's own engineering industry to cope with the consequent orders for plant. Two documents bearing on these points have just come into our hands, viz., a review of economic conditions by the Swiss Bank Corporation, and a note on Switzerland's water power in *The Anglo-Swiss Review*.

Rise in Wages.—Already Swiss industrialists have adopted the policy of establishing branch works in countries where that appeared to be the best method of tackling a market. This course has been pursued in the case of the machinery trades as well as in others perhaps better known, *e.g.*, condensed milk and chocolate. Hitherto the necessary capital has been provided by the parent concerns or closely allied financial groups; now funds are being sought in the countries where such branches are set up.

It must be said, however, that although Swiss industrialists complain of the reduced output of their workpeople, it is doubtful whether they will find much improvement in this respect in other countries, save perhaps in those where it would be useless to seek funds for the establishment of branch works.

The Association of Machinery and Metal Manufacturers has published the following table showing the effective wages of their workmen during recent years:—

	Average weekly wage of adult workmen. (Francs.)	Index of wages increase (adults).	Index of cost of living.
June, 1912	35.34 ...	100 ...	100
June, 1914	37.50 ...	105 ...	95
June, 1918	61.30 ...	174 ...	180
June, 1919	74.20 ...	210 ...	205-210
December, 1919 ...	77.85 ...	220 ...	205-210

When the figures for 1920 are complete it is expected that a further tendency in the same direction will be shown. It is estimated that as a result of increases in wages granted since the commencement of the war, the workers' conditions have been improved not merely sufficiently to compensate for the general rise in the cost of living, but by an additional 15 per cent. to 20 per cent. for all classes. Swiss manufacturers find themselves in consequence paying higher rates of wages than their international competitors. They ascribe much of their difficulty to the enforced adoption of the eight-hour day.

At the beginning of last year, new factory legislation came into force, and manufacturers have been chafing under its stringency. It enacts a maximum of 48 hours per week save under special authorisation, and places a strict limitation on overtime. Even if employers and employés agree together, the 48 hours may not be exceeded. In spite of concessions and increased wages (these have been doubled since 1914), there appears to have been a falling-off all round in quality and quantity of work.

Whilst a satisfactory state of activity prevails in the machinery works, it is felt that something like a crisis is approaching in the electrochemical industry, the majority of producers having shut down owing to the absence of export orders.

Use of Water Power.—The demand for cheaper electricity in Switzerland has given rise to a series of very interesting investigations. The Association of Swiss Electricians suggests the following two remedies: The erection of bigger power stations and the creation of more extensive artificial lakes for the storage of water, and the sale of energy by night at a cheaper rate than by day.

The creation of artificial lakes or accumulator lakes for the storage and control of the water supply of power stations has such undeniable advantages over the old method of procedure, that accumulator lakes are now being constructed wherever it is possible to do so. By damming a valley at a suitable spot a huge water reservoir can be created with a comparatively small expenditure of labour. The supply of water for the turbines is no longer entirely dependent

on the water level of the river, and can be regulated at will by releasing more or less water from the reservoir.

The utilisation of hydro-electric power in Switzerland is of comparatively recent date, extending back for hardly more than 20 years. Since then the development has been extremely rapid. The war put a temporary stop to constructional work, but in 1916 it began again with renewed vigour. In no other branch of economics in Switzerland has such progress been made since then. To-day the capital invested in the various hydro-electrical undertakings in the country can hardly amount to less than one milliard francs.

At the beginning of the year 1914 the number of works in existence was 6,860, the average net output of which totalled 526,000 h.p. During the war these were found insufficient to meet the new demand, and they were enlarged by various temporary devices wherever it was possible. The level of most of the Swiss lakes was raised—among them the lakes of Geneva, of Neuchatel, of Lucerne, &c.—and a considerable increase in the power output was obtained during the winter of 1917-18.

In addition to these temporary measures, the erection of a number of new power stations was begun. Following is a list of the most important power stations that have been erected since that date. Some of them have not yet been completed: Laufenbourg, 25,000 h.p.; Bramois, 16,400 h.p.; Fully, 12,000 h.p.; Olten-Goesgen, 80,000 h.p.; Biaschina, 15,000 h.p.; Eglisau, 32,200 h.p.; Amsteg, 80,000 h.p.; Ritom, 72,000 h.p.; Muehleberg, 64.000 h.p.; Broc, 24,000 h.p.; Loentsch, 15,000 h.p.

Export of Energy.—The power stations of Ritom and Amsteg with their combined power of 152,000 h.p. are destined to supply the necessary current for the electrification of the St. Gothard line.

The exportation of energy to the surrounding countries has caused no little interest in Switzerland, and has frequently been a subject of comment in the Swiss Press. The exportation of energy has had to be authorised in every case by the Federal Government, and a maximum amount to be exported has been laid down. The maximum amount authorised up till the end of 1919 was approximately 100,000 kW, and was distributed in Germany, Italy, and France. It is very probable that in years to come Switzerland will be able to supply the surrounding countries during the summer months with a considerable amount of electrical energy which will be returned during the winter by power stations worked on the big coalfields in Germany and France. The saving in coal which would thus be effected would, when viewed in the light of the rapidly dwindling European coal resources, be a substantial step towards the solution of the present difficulties besides considerably stabilising Switzerland's economical position.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Lead-covered Wiring.

In my town a large amount of lead-covered cable is used for installation purposes by contractors, and I shall be glad if you will give me an indication as to how far any rules issued by the I.E.E. are legally binding in respect of any system of wiring. I have understood that the above-mentioned system is condemned.

If, for the sake of securing a contract, a firm can put in any rubbish, with the consequent liability to fire, what is the remedy?

There are, doubtless, many people who pay the price of a screwed or grip conduit system, and in return receive something which is not only a positive danger to themselves, but a bad advertisement for the supply authority. It is possible that chief engineers do not realise the dangers of cheap wiring owing to the fact that contract work is outside their domain.

If any recognised rules are binding, it appears to me that the sooner many chief engineers assert their authority the less we shall hear about "fires caused by an electric fuse."

Bourgeois.

March 2nd, 1921.

[The only wiring rules that are legally binding are those issued by the Board of Trade (now by the Ministry of Transport) for pressures exceeding 250 volts, and the Home Office Regulations for Factories and Workshops. The I.E.E. Wiring Rules have no legal force; they do not forbid the use of lead-covered cable, but Rule 68x prescribes the methods of installing and protecting it.

There is no legal remedy for damage resulting from bad wiring, other than that provided by the civil law.

Electricity supply engineers, with a few exceptions (where special powers have been obtained) have no power to "assert authority" over wiring. They can refuse to connect an installation unless they are reasonably satisfied that the wiring, fittings, and apparatus are in good order, and not calculated to affect injuriously the use of energy by themselves or other persons; unless they can substantiate their objection, they are liable to a penalty not exceeding 40s. a day during the default. Apparently the only recognised criterion of the condition of an installation is a leakage test prescribed by the Board of Trade.

The best remedy for shoddy wiring is the registration of contractors, which the Electrical Contractors' Association is endeavouring to secure.—Eds. Elec. Rev.]

Standard Costing Systems.

May I say how much I enjoyed your leading article of February 25th?

It would seem that the idea of costing as a necessity to every manufacturing concern has been rather too readily accepted. What is not so readily accepted is the certain standard of efficiency for which you plead. It is for the works accountant to keep this standard always before the management—and himself. He must, in short, be an idealist, for one hears of costing systems which were only perfected after years of investigation and hard work.

Your suggestion that standard systems might be applied to the various branches of the engineering trade, as the "Federation system" is applied to the printing trades, is admirable. One may hope that this question will soon be actively taken up.

It would surely be a simple matter to form committees of works accountants and practical engineers representing the various branches of the trade? This, I submit, is a first step which should carry us far.

W. Pope.

Wakefield.
March 4th, 1921.

Income Tax.

With regard to the Chancellor's announcement that a Bill will shortly be introduced abolishing the three years' average system, it may be well to consider the position produced by the alternative proposal to substitute (as recommended by the Royal Commission) the profits of the preceding year, having regard to the serious slump which has taken place in so many businesses.

Hitherto the three years' average has been based upon the profits for the three years ending on the date, preceding the year of assessment, to which the accounts have usually been made up, and most probably a similar system will be adopted with regard to the new basis of assessment.

Thus if a firm makes up its accounts to June 30th, the assessment for 1922/'23 would be based on the profits for the year ending June 30th, 1921, and would thus include a large portion of the period prior to the slump. It is therefore an important question whether, in many businesses, it might not be advantageous to change the financial year so as to end on March 31st, in which case the assessment for 1922/23 would be based, as it should be, on the twelve months to March 31st, 1922. The Revenue officials could scarcely raise objection to this method being adopted, as it is merely carrying out the system advocated as nearly as possible.

May I suggest, therefore, that traders and manufacturers to whom this might be an advantage should take stock on the 31st of the present month so that later on in the year, when they will be able to judge whether it is advantageous to adhere to their old financial year or not, they will be in a position to adopt either system.

Chas. H. Tolley.

London.
March 7th, 1921.

The Severn Barrage Scheme.

In your account of the discussion on the above at the joint meeting in Birmingham, which appeared in your issue of February 25th, you report some remarks which I made. There are one or two errors in the figures which you quote, which I should be obliged if you will correct. The horse power available should be 7,000 b.h.p. instead of 700; the units developed per annum 15,000,000 and the units utilised 12,000,000, instead of 150,000,000 and 120,000,000 respectively.

F. J. Moffett.

Birmingham.
March 7th, 1921.

[The errors occurred in the official report, and appeared also in our contemporaries.—Eds. Elec. Rev.]

Payment According to Ability.

As a regular reader of the Review, I note certain ideas of contributors on the cause of low production. I am only a workman cable jointer; my idea is that none of your contributors have stated the right cause. It all lies in the system of wages. The grading, as it is called, would be better done away with. There should certainly be a decent starting wage in every trade, and for skilled and unskilled labour, and every man should have to undergo a work test to prove his capabilities before he was put on the books.

Take any class of work you like—for a start we will take a large fitters' and turners' shop where they employ 250 hands;

one-third of those will be good skilled mechanics and proper workmen; one-third will be fairly good men; the last lot will be men who are not worth their keep; yet they all get a standard rate. The consequence is that the skilled men will only do the same amount of work as the poor lot.

Then again, take a man who has served his time learning his trade, and has worked, say, 15 years at it besides; if he is any sort of a man his experience should make him worth all he gets by that time. Then take a young man who has just served his time, and is starting as a mechanic; he will receive the same wage as the man who has had the 15 years' experience.

It is the same in all trades nowadays. Trade will get worse instead of better if the wages system is not altered. Take my own case as a sample. I am an all-round man at cable work—making, laying, jointing, &c., but a non-plumber where I work now. I have done as much jointing in one day, by myself, as any two men that have ever been here. Yet we have men here who have not had a quarter of my experience; and I could make two joints to their one, and they are getting the same wage as me, and some of these men I have learnt them their work. I say let's have a fair starting wage for all, then let wages rise according to abilities and not by favour or chin wagging; let every man know that if he is worth more he will get it. You will soon find the good workmen then, and also the won't or can't workers.

A Regular Reader.

February 26th, 1921.

BUSINESS NOTES.

Easter Holidays.—The advertisement department of the ELECTRICAL REVIEW draws the attention of advertisers to the arrangements for our issue of Friday, March 25th. As this will be published on the morning of Thursday, March 24th, it is necessary for new copy and alterations to existing displayed advertisements to reach 4, Ludgate Hill, by the morning of Thursday, March 17th (next week). Official notices and small prepaid advertisements can be received up to 5 p.m. on Tuesday, March 22nd.

It will, of course, be necessary for editorial matters to reach us earlier than usual.

Bankruptcy Proceedings.—*Re* MALCOLM THOMAS BIRCH GORDON, 2, Beverley Road, Chiswick, and 165, King Street, Hammersmith, lately carrying on business at 20, Western Broadway, King Street, Hammersmith, under the style of Thomas Gordon, electrical and general merchant.—At the London Bankruptcy Court, on Monday, before Mr. F. T. Garton, Official Receiver, the first meeting of creditors was held under this failure. After dealing with the proofs of debt lodged, the Official Receiver stated that the debtor was at present employed as a traveller, but until March last he carried on business in his own name as a dealer in electrical accessories. He left school at the age of 17, and went to India, where he was trained as an electrical engineer. In May, 1915, he commenced business on his own account, dealing in electric pocket lamps. He had no capital of his own, but he was joined in partnership by two other persons, who provided £25 each, and they traded as the Felux Co. The business was successful until November, 1915, when the supplies were stopped, and the business practically came to a standstill. His partners then left the firm, and he continued it under the name of Thomas Gordon at the same address. One of his creditors subsequently took back goods valued at £600, and another creditor goods to the value of £100. In February, 1920, the business again came to a standstill, but it was afterwards purchased by another firm who had since employed the debtor as traveller. He was sued by one of his creditors, and decided to file his petition. He executed a deed of gift to his wife, prior to his marriage in 1918, which covered the whole of the household furniture. He alleged his failure to have been caused through heavy interest on borrowed money, bad debts, and falling off in trade. The debtor had been adjudicated bankrupt, and a summary order obtained for the realisation of the estate. The statement of affairs showed liabilities amounting to £807, and assets £17, thus leaving a deficiency of £790. The estate was left in the hands of the Official Receiver for summary administration in the usual manner.

HENRY JOHN MONSON, described as a radiographer, of 26, Manchester Street, W.—At a sitting of the London Bankruptcy Court, held on March 4th, before Mr. Registrar Francke, an application was made for an order of discharge on behalf of bankrupt. The Official Receiver reported that in October, 1911, the bankrupt commenced the electrical treatment of rheumatic, &c., patients, and in May, 1919, he transferred the business to a private company registered as Henry J. Monson, Ltd., which went into voluntary liquidation in the following December. The business was subsequently assigned to him by the liquidator for £1,156, which was set off against his interest in the company, and he continued the business until execution was levied on his effects by a creditor in August, 1920. He was made bankrupt in November, 1920, with liabilities £2,662; the assets had realised £237, and a dividend of between 1s. and 1s. 3d. in the £ would shortly be paid. The bankrupt attributed his failure to mismanagement by others of the company's business, and consequent loss of his shares in the company; to loss by the forced sale of his effects, and to interest on loans. The discharge was granted subject to a judgment for £5 to be satisfied by an immediate cash payment.

W. H. MELLON (H. B. Wallis & Co.), electrical engineer, 37, Elliott Road, Chiswick. Trustee (Mr. T. Gourlay, 14, Bedford Row, W.C.) released February 25th.

A. E. GOODINGS, motor and electrical engineer, The Grove, Watlington Street, Reading.—Receiving order made March 4th, on debtor's own petition.

J. V. BELL, electrical engineer, 21, North Bar Within, Beverley, York.—Trustee (Mr. E. P. Dutton, Bowlalley Lane, Hull) appointed March 3rd.

J. SKINNER (Foster, Skinner & Co.), electric fittings dealer, 6, South Castle Street, Liverpool.—Last day for proofs for dividend, March 23rd. Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

Company Liquidations.—STEEL WING CO., LTD., 48A, Gillingham Street, S.W.—Under a compulsory winding-up order, the report of Mr. W. J. Warley, Official Receiver, has been issued to the creditors and shareholders. The company was formed in May, 1903, by the late Mr. George Pauling as the Krieger Electric Carriage Syndicate, Ltd., its primary objects being to acquire certain patents relating to electric vehicles, and to let out and vend such vehicles. The nominal capital was increased from £30,000 to £100,000, but was reduced to £72,250 by resolution, confirmed by the Court, in March, 1909. The business was carried on at a loss for some years, but in 1915 it was extended to include the construction of aeroplane wings and accessories. Contracts were obtained from the Air Ministry, and a mortgage for the sums payable thereon was given to the company's bankers to secure an overdraft. The accounts filed under the liquidation showed liabilities £27,064 against assets valued at £11,505, and a deficiency of £43,319 with regard to contributories. The failure of the company is attributed to an action launched in connection with the company's indebtedness to the promoter.

The statutory first meetings of the creditors and shareholders were held on March 3rd at the Carey Street Offices of the Board of Trade, Lincoln's Inn, W.C., before Mr. W. J. Warley, Official Receiver. No resolution was passed at either meeting, and the liquidation was left in the hands of the Official Receiver.

ELECTRICAL INDUSTRIES, LTD., 9 and 10, Pancras Lane, Queen Street, E.C.—A compulsory winding-up order was made against this company on January 18th, upon the petition of a creditor, and Mr. W. J. Warley, Official Receiver, has now issued his report to the creditors and shareholders. The accounts filed under the liquidation show unsecured creditors £1,611; preferential claims, £65; loans on debenture bonds, £1,050; assets valued at £1,045; and a deficiency of £2,033 as regards contributories. The company was registered as a private company in May, 1920, with a nominal capital of £2,000, its objects being to carry on business as manufacturers of, and dealers in, electric fires, lamps, &c. Mr. Edmund Woodroffe was the promoter of the company, and acted as sole director until October 4th, 1920. The company agreed to take over the business of Mr. E. G. K. Calder, a dealer in electrical appliances, and to manufacture and sell electric fires under a licence granted to the company by Mr. A. E. Woodhouse. In December, 1920, a debenture for £1,050 was granted to the Industrial Debenture Corporation, Ltd., to secure previous loans and a further advance of £50, and during the same month Mr. Edmund Woodroffe was appointed receiver on behalf of the debenture-holders. The Official Receiver observes that having regard to the date on which the debenture was issued, its validity was contested, and, as a result, it has been agreed to admit the debenture-holders as secured creditors for £50, and as unsecured creditors for the balance of £1,000. The Official Receiver has taken possession of the company's assets. The failure of the company is attributed to heavy overhead charges, fall in market price of goods purchased, and to the failure of a customer to take delivery of goods which had been purchased for £375.

HARMAN ELECTRIC CO., LTD.—Meeting of creditors, March 16th, at 9, Walbrook, E.C. Liquidator, Mr. F. M. Jeboult.

F. HUDSON & CO., LTD.—Meeting of creditors was held on Wednesday, 9th inst., at 89, Chancery Lane, W.C. 2.

Dissolution of Partnership.—JOHNSON & CO., electrical engineers, 23, Piccadilly, Bradford.—Mr. A. Johnson, H. Hirst, and L. Harding have dissolved partnership. Debts will be attended to by Messrs. Johnson & Hirst, who will continue the business.

Trade Announcements.—Mr. W. T. Bower has resigned his appointment as managing director of ELECTRICAL COMPONENTS, LTD., and, pending the appointment of his successor, Mr. H. S. Secombe (a director and London representative), will act as manager.

MR. A. G. PERRING, of Unity Buildings, 14, Temple Street, Birmingham (telephone, Birmingham Central 2159), has been appointed to represent Messrs. H. W. Smith & Co. (1920), Ltd., in the Birmingham District.

MESSRS. C. LORENZ AKTIENGESELLSCHAFT, Berlin, have purchased the Wild-Barfield patent rights for Germany, Poland, and the former Austria-Hungary. Messrs. Lorenz have already placed a first order with Automatic and Electric Furnaces, Ltd., for various parts to complete nearly 100 furnaces.

The Hamworthy Engineering Co., Ltd., has opened a branch office at 22, Dean Street, Newcastle-on-Tyne, with Mr. P. E. Brittain as Northern sales manager.

Messrs. J. M. Juniper & Son, electrical contractors, have opened new premises at 115, Chorley Road, Swinton, Lancashire.

The telephone number of Automatic and Electric Furnaces, Ltd., is now "Museum 4187."

Messrs. H. Pratt, Ltd., of High Street, Aston, Birmingham, have opened an electrical department in connection with the installation of electric lighting and power plants and the sale of electrical plant and accessories. They desire to receive catalogues and prices from manufacturers.

The London Electric Stores, of 39, Furnival Street, High Holborn, London, have been appointed sole London agents for the following firms:—Messrs. Ironclad Switchgear Co., Ltd., Eccles, manufacturers of ironclad switchgear; Messrs. Baker & Hyman, Ltd., Leeds, manufacturers of starters, resistances, &c.; Messrs. S. E. Giles, Kobe, Japan, importers of electrical accessories.

Catalogues and Lists.—Messrs. Pettigrew and Merriman, Ltd., 7, Henrietta Street, Covent Garden, W.C. 2.—An illustrated and detailed booklet (14 pp.), dealing with the "Select-o-Phone" for interior communication.

Henry Wells Oil Co., 11, Haymarket, S.W. 1.—A booklet entitled "The 'Germ Process' in a Nutshell," giving many details of this process of lubrication applied to various types of machinery.

Lanston Monotype Corporation, Ltd., 43 and 43a, Fetter Lane, E.C. 4.—An illustrated booklet giving particulars of "Radbore" heads for boring square holes.

Simplex Conduits, Ltd., Garrison Lane, Birmingham. "Installation News," February, 1921.—This booklet describes rectangular multiple switch boxes, lighting fixtures, &c.

Messrs. Campbell & Isherwood, Ltd., Raleigh Street, Bootle, Lancs. General catalogue (103 pp.).—This is a well-produced and profusely illustrated list of electrical machinery and accessories. The catalogue includes steam-driven generating sets of 3½ kW and above, electrically-driven winches, motors, hoists, switch and fuse gear, gearing, ship's lights, measuring instruments, &c. Many useful tables are embodied in the publication, including the fusing current for wires of various materials and sizes, mechanical and electrical units and equivalents, thermometer scales, metric conversion tables, &c.

Engineering and Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—An illustrated and priced booklet of fittings for "half-watt" and metal-filament lamps, including lanterns, reflectors and bowl fittings of many types.

Messrs. Kenrick & Jefferson, Ltd., 22, St. Andrew Street, E.C. 4. "K. and J. News," No. 1.—A booklet dealing with office furniture of various types, including desks, chairs, filing systems, &c.

The Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N. 7.—An illustrated price list of "Ever-Ready" dry batteries for wireless sets, rangingfrom 15 to 100 volts.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—Three leaflets, illustrated and priced, dealing with "Revo" house service switches and fuse boxes and electric light fittings (lanterns, bowls and watertight switches).

Messrs. L. G. Hawkins & Co., 116, Charing Cross Road, W.C. 2.—"The Link," Vol. I, No. 2, containing notes on shop window displays, and "Universal" appliances, with current prices.

The Hamworthy Engineering Co., Ltd., 76, Victoria Street, S.W., 1.—An illustrated leaflet giving price and details of the "Powerlight" 2½ b.h.p. lighting set.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—Two illustrated advance lists of "Glasgow," "Kantark," and "Paragon" switchgear, giving revised prices.

The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—Abridged catalogue No. BB 143, giving illustrations and prices of electric bells, buzzers, indicators, pushes and accessories.

The Wallwin Co., Saltisford Ironworks, Warwick.—A folder advertising soft grey iron castings, and giving views of the company's works.

Messrs. J. F. Irvine & Co., Ltd., City Hall (Dock Street), Dundee.—Priced leaflet of "Plexaim Royal" electric suction cleaners.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Catalogue P (3) Section, dealing with d.c. motors; full details and illustrations are given. Catalogue P (4) Section; "Witton" a.c. motors; illustrated and dimensioned.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C. 4.—A booklet dealing with "Roto" boiler tube cleaners, and a leaflet illustrating the "Torpedo" soot remover.

Twiss Electric Transmission, Ltd., 62 & 63, Queen Street, E.C. 4.—List TL 2a, illustrating and describing surge-proof pin insulators, spindles and clamps, with details of tests carried out upon insulators.

Lead.—Messrs. James Forster & Co., reporting under date March 5th, stated that the week had seen a very natural reaction from the low level of values touched on the last market day of the preceding week. "Highest prices paid were on Thursday, when £19 7s. 6d. was done for June, and £11 15s. March. The turnover was on a small scale, sales aggregating about 3,000 tons. . . . In the face of expectation of further supplies of the metal arriving from the Continent in the near future and the very spasmodic trade demand, it is doubtful whether present prices can be maintained. On the other hand, it must not be forgotten that lead is selling below production cost, and, in the long run, on a return to normal conditions, prices must advance to alpermanently higher level."

An Effective Fire Showcard.—A novel design of showcard is being issued by The English Electric and Siemens Supplies, Ltd., Brook House, 191-192, Tottenham Court Road, W. 1; it is printed in attractive colours, and carries a model of the 1-kW Britannia fire. This model is illuminated by means of a 30-watt lamp carried in a box attachment fitted direct on to the back of the card, and a realistic reproduction of the glowing fire is thus obtained. Transparencies let into the card complete the advertising value by vividly displaying the name "Britannia Electric Fires," and the slogan "Cheerful and economical." A thermo-electric "flasher" can be connected to the lamp circuit should the exhibitor desire to obtain an intermittent illumination effect. The whole device folds flat, and is enclosed in a cardboard box to facilitate dispatch. These showcards are offered to all electrical dealers interested in the sale of Britannia fires, and afford an opportunity of effectively demonstrating a 1-kW fire with a consumption of 30 watts.

British Industries Fair.—Following upon a visit by a Swiss Commission to the Birmingham Section, a number of nationalities were represented in a large party which inspected the exhibition on March 2nd. The delegates were principally officials of the various Departments of Trade, but a number of business men also attended. The countries whose delegates attended were the United States, Belgium, Bulgaria, Canada, Czecho-Slovakia, Denmark, Holland, Finland, France, Italy, Norway, Poland, Portugal, Rumania, Jugo-Slavia, Sweden, and Switzerland. The visitors expressed their appreciation of the Fair and the hospitality extended them. A dinner, presided over by the Lord Mayor, was given to the delegates by the organising council.

Errata.—We regret that in our description of the Birmingham section of the Fair, last week (p. 289), we inadvertently styled the Midland Supply Co. as the Midland *Electric* Supply Co. The G.E.C. "Klersite" dynamo was also referred to as a magneto in one or two places. This is a series-wound machine.

Milan Sample Fair.—Under the patronage of the Italian Minister of Commerce, the International Sample Fair of Milan will be held from April 12th to 27th next in buildings specially constructed for the purpose. The object of the Fair is to place buyers in direct contact with producers. The trades and goods that will be represented include:—Agriculture, textiles, clothing, jewellery, silverware, sanitary appliances, chemistry, timber, minerals, glass and chinaware, paper, printing, furniture, automobiles, aviation, cycles, electricity, building construction, hydraulics, metallurgy, &c. The business transactions at the Fair last year amounted to upwards of 1,000,000,000 lire. A stand with an area of about 12 sq. metres, costs about £16. Special terms are arranged for several firms occupying the same stand. An interesting booklet in English has been issued by the Organising Committee, copies (gratis) of which can be had at the London offices of the Italian State Railways, Waterloo Place, Regent Street, S.W. 1, where arrangements incidental to the journey to Italy (reservations on trains, through tickets, &c.), can be made. There is every indication that both British buyers and British industries will be well represented at this Fair.

Low German Tender for Sheffield Plant.—According to the *Sheffield Daily Telegraph*, Mr. S. E. Fedden, general manager of the Sheffield Electric Supply Department, speaking at the second annual dinner of the Sheffield Section of the Junior Institution of Engineers, on 4th inst., said that during the last few days he had received a German offer of a large plant which complied in every way with the requirements of the city's supply department. It was offered at £40,000, and the lowest tender by English manufacturers for the same thing was £100,000. How could we possibly compete with that sort of thing? By working long hours at low wages the Germans were making a bold bid to be in the position of victors instead of vanquished. Dealing with the industrial situation at home, Mr. Fedden said that it presented a most difficult problem at present and, personally, he felt that there were still greater difficulties to be faced before industry really settled down to its normal level. Such a position could be restored only by everybody putting his back into work.

"Wages in all branches of industry will have to come down" he continued, "and they will have to come down heavily. The sooner we face it the better, but politicians will not face the fact. Wages have got to come down, and the sooner the working men realise it the better. Otherwise half the population will have to emigrate." Along with less wages must come less profits if the situation was to be saved.

The price of coal must be brought down to half or even lower, and therefore there must be a big cut in miners' wages. This would be followed by lower railway rates, and so on.

Czecho-Slovakia.—*Trua*, the new organ for the electrical trade in the Czecho-Slovak Republic and East Bohemia, which has seen its eleventh issue, is mainly a workman's organ, but the highest branches are catered for, its editor being Engineer Gustav Meyer. It is interesting to observe that, while advocating the Socialist standpoint, it is emphatic regarding the Bolshevic version of it. "Russia," it says, "which, after the collapse, took the first step to realise the beautiful Socialist idea, can offer us generally no good example." Its Socialism, apparently, is of the respectable, rational order, which seeks to raise the working class by self-education, both technical and economic. This education, it says, will save them from the "unreason of striking workmen," whose action in the past has ruined rich industries, or rendered them useless for indefinite periods for the welfare of whole kingdoms. "In this connection Russia offers us a sad and warning lesson."

Book Notices.—The "Practical Engineer" Electrical Pocket-Book and Diary, 1921. (610 pp.). London: The Technical Publishing Co., Ltd. Price, 2s. cloth, 2s. 6d. best binding, net.—The twenty-second issue of this pocket-book has been revised carefully, and additions have been made in many directions. The section on "Wireless Telephony" has been amplified to include thermionic valve reception, &c. New information is given on power-factor indicators, and the use of condensers for improving power-factor. The section on "Patents" has also received attention.

"The Electrical Power Engineer." Vol. II, No. 8. February, 1921. Price 4d.—In this issue the editor complains of lack of contributors, but admirably fills the gap himself. Reports of negotiations in the matter of the National Joint Board award, notes on the Ilford dispute, &c., occupy a large part of the journal.

The *Journal* of the Röntgen Society. Vol. XVII, No. 66. January, 1921. (48 pp.). London: Percy Lund, Humphries & Co., Ltd. Price 5s. net quarterly (to non-members).—The Presidential Address of Dr. Robert Knox is given in full, and many important subjects are dealt with. "X-Ray Work at Schenectady," by Dr. W. D. Coolidge (with discussion), and "Electrons" (Twelfth Kelvin Lecture), by Sir William Bragg, K.B.E., F.R.S., also appear, as well as abstracts of current literature upon radiology, &c.

"Electric Bells, Alarms and Signalling Systems." By H. G. White. Pp. 114, 75 diagrams. London: S. Rentell & Co., Ltd. Price 3s. 6d. net.

"High-Tension Switchgear." By H. E. Poole. Pp. viii + 118; 36 figs. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

New Indian Company.—Among the new companies connected with the supply and distribution of electricity in India is the Maymyo Electric Power Station, Ltd., Maymyo, Burmah, capital 500,000 rupees.

The Revival of German Industries.—Ex-President Poincaré, in the political article in the *Revue des Deux Mondes* (February 1st), dealing with Germany's reparations, argues that her ability to pay lies, not in the amount of her actual capital, but in her annual productive capacity, and adduces as evidence of the increase of that capacity the following illuminating information on the rapid recovery of German industry, furnished in a public lecture by M. Georges Blondel, Professor at the Collège de France, who has paid several visits to Germany since the peace, and corroborated by all the leading German papers. At Essen, Bochum, and Dortmund, the ironworks are in full activity. The great firms of Krupp, Thyssen, Stinnes, and Mannesmann distribute dividends of 10, 15, 20, 40, and even 50 per cent. The Allgemeine Elektricitäts Gesellschaft has just distributed 14 per cent., and Krupp reports net profits of Mk. 69 mill. The textile industry is equally flourishing. The *Kolnische Zeitung* (January 7th) states that the mills have resumed full activity, and are distributing dividends of 10, 15, and 18 per cent. In the chemical industry, the firm of Bayer, of Leverkasen, has recently paid a dividend of 18 per cent. On all sides are to be seen the same signs of recovery. The wood industry has been reorganised the more rapidly, in that Germany possesses immense forests, 39 per cent. of which, in the form of domain and Crown forests, are owned by the State. The paper industry has no longer anything to complain of, and the Reishotz works have also paid a dividend of 18 per cent. While the majority of French banks dare not look up any of their funds, and in many cases are living from hand to mouth, the German banks realise large profits and distribute dividends varying from 10 to 25 per cent. The cartel system, which was so widespread before the war, has been re-established in all its force, as the *Kolnische Zeitung* and *Germania* exultantly proclaim. To-morrow we shall see German industry rejuvenated, and, led by a select number of bold captains of industry, ready once more to capture the world's markets. All the better for Germany. This marvellous revival does credit to her spirit of initiative, her will, and her patriotism. We are not so ungenerous as to fail to do justice to these remarkable efforts. But at least let her cease from shouting ruin. Do not let her continue to pose as the insolvent debtor, and let her lay aside the disguise of starvation and poverty.—*Economic Review.*

Registration of Contractors.—The *Electrical Contractor* says that one of the most important matters immediately before the Electrical Contractors' Association is the question of Registration. Every effort is being made to press this claim before the Government Departments which have power to initiate the necessary legislation.

Prices Reduced.—The Bastian Electric Co., Ltd., announces that, owing to the lower cost of raw material, it is reducing the list prices of Bastian tanks and accessories by 10 per cent. We understand that upwards of 200 of these tanks have now been installed, with satisfactory results.

Scandinavian Electricians' Union.—*Berlingske Tidende* learns from Christiania that a meeting has been held there between representatives of the Danish, Norwegian, and Swedish Electricians' Unions. Important decisions were reached, the chief one being an agreement by which, in case of a serious dispute in one of the Unions, the other Unions would be bound to contribute pecuniary support amounting to at least Kr. 90,000 during a period of 12 weeks. In less important disputes assistance is to be afforded according to a fixed scale. These and other agreements will have the effect of combining the three Unions into what, for practical purposes, will be one body.—*Reuter's Trade Service* (Copenhagen).

Trade-Mark Applications.—Appended is a summary of the recent applications for British trade-marks in connection with the electrical industries and trades:—

Wagner Quality (lettering and design). No. 401,788. Class 6. Electrical machinery. Wagner Electrical Manufacturing Co., 6,400, Plymouth Avenue, St. Louis, U.S.A. March 12th, 1920.

Singalvo. No. 409,749. Class 11. Electric appliances for curative purposes. Paul Bischofberger, 21, Central Strasse, Lucerne, Switzerland. November 15th, 1920.

W (letter in form of design). No. 407,511. Class 13. Electrical goods. Mitchell & Co., Ltd., Endwell Works, Endwell Road, Brockley, S.E. August 28th, 1920.

G.H.B. (lettering and design). No. 410,074. Class 13. Sparking plugs. G. H. Barraclough, John Street, Thornton, Bradford, Yorks. November 26th, 1920.

Leofur. No. 408,431. Class 18. Electric furnaces, electric rivet heaters, and electric hardening and tempering plant. Leeds Electric Construction Co., Ltd., Charmouth Street, Leeds. October 6th, 1920.

Dagea. No. 409,771. Class 18. Electric heating and cooking apparatus. Auerlicht Gesellschaft, 11-14, Ehrenberg Strasse, Berlin. November 13th, 1920.

Westinghouse (lettering and design). No. 410,655. Class 13. Connectors for secondary batteries. Westinghouse Union Battery Co., Swiss Vale, Penn., U.S.A. December 15th, 1920.

Commercial Experts to Visit Italy.—At the suggestion of the former British Ambassador, Sir Rennell Rodd, the Lord Mayor of Glasgow is arranging that between two and three hundred important persons from political, industrial, and commercial centres in Glasgow, Manchester, Liverpool, and London will shortly make a trip to various Italian cities, including Milan, Venice, Florence, Genoa, and Rome. The party is expected to arrive shortly. Commercial circles here welcome the visit, as it will enable English business experts to ascertain the situation in Italy for themselves, and thus initiate the strengthening of business relations between their country and Italy.—*Reuter's Trade Service* (Rome).

Catalogues for Venezuela.—A commercial museum is to be established in connection with the Department of Commerce in the Ministry for Foreign Affairs of Venezuela. The museum is intended to be a permanent exhibition of samples of both home and foreign products, of catalogues of foreign firms, commercial reviews, &c., and a free information service with regard to these matters will be maintained. The Director of the Department of Commerce has informed H.M. Vice-Consul that United Kingdom samples, catalogues, in fact, anything that will help to promote trade between the two countries, will be gladly received, and should be addressed as follows:—Senor Director, Direccion de Politica Commercial, Ministerio de Relaciones Exteriores, Caracas, Venezuela.

Underground Efficiency.—In pursuance of the sixth series of Staff Efficiency Meetings organised by the Underground Companies, the fifth meeting was held at the L.G.O.C. Training School at Chelsea. It was attended by upwards of 300 members of the Administrative and Control Staff. A paper on "Lifts and Escalators" was read by Mr. W. S. Graff Baker, electrical assistant to the mechanical engineer of the Underground Railways, and was followed by a general discussion. The importance of the subject is emphasised by the fact that nearly 1,000,000 passengers are carried by the Underground lifts and escalators every week-day.—*Islington Gazette.*

Social Events.—The members of the Victoria Works Athletic Club (Messrs. Johnson & Phillips, Ltd., Charlton, S.E.) held their annual dinner on Saturday, 5th inst., in the club-rooms attached to the works. The chair was occupied by the president, Mr. H. J. Sheppard, general manager of the firm, supported by the vice-presidents (departmental managers). After dinner the usual toasts were given, with a concert following, the artistes all being members of the club and firm.

German Electric Companies in Sweden.—The Siemens-Schuckert Co. and the Allgemeine Elektricitäts Gesellschaft have formed a new company at Stockholm for the purpose of manufacturing and selling incandescent lamps and electric apparatus. The minimum share capital is fixed at Kr. 250,000.—*Reuter's Trade Service* (Stockholm).

For Sale.—By direction of the Disposal Board, Mr. H. D. Phillips will sell by auction on March 22nd, 23rd, and 24th, at the Royal Hotel, Bristol, shipyard plant, cranes, machine tools, electric generators, motors, cable, &c., lying at Beachley, Portishead and Portbury, and Frampton gravel pits. Mr. G. Tinsley will sell by auction on April 13th and 14th, at the South Careton Aerodrome, Lincs., huts, hangars, and machinery, including the contents of the power station, also surplus materials, fixtures, &c.

Messrs. A. T. & E. A. Crow will offer by auction on April 7th, at Lemington, near Newcastle-on-Tyne, a quantity of electrical plant, motors, machine tools, &c., lying at depôts in the Newcastle district.

Peterborough Corporation Electricity Department invites offers for one 240-kW d.c. generating set, one 120-kW ditto with one spare armature, various pipes, valves, &c.

Accrington Corporation Electricity Department has for disposal a surface condensing plant, by Ashton, Frost & Co., complete with pumps, oil separator, &c.

Winchester Corporation invites offers for two 200-kW generating sets. For full particulars, see our advertisement pages to-day.

Art in Illumination.—There is increasing evidence that the enormous possibilities of lighting as a means of beautifying a building, as well as serving its primary object, are being realised more and more. People are not satisfied nowadays with a plain lamp and reflector which clash with their surroundings, but seek to find a means of illumination which, while efficient, falls in with the general scheme of things. In these circumstances a collection of such means becomes of more than ordinary interest. Messrs. Albert Lee & Co., Ltd., 8 and 9, New Zealand Avenue, E.C. 1, have recently instituted a display of this nature. Behind a rather unpretentious exterior they have amassed an exhibition of all kinds of lighting fittings showing excellent taste and variety. The show-room is of ample size, and is not over-crowded in spite of the multitudinous nature of the display. From the ceiling are suspended many types of bowl fittings in alabaster, carved "rottenstone" and glass of all kinds, including some examples of pressed glass, which is a wonderful imitation of alabaster with a "moonstone" effect. There are lanterns of all periods, and the old brass and ironwork is very true to type. The cut-glass bowls, of which there are numerous examples, are of very fine workmanship, and the same may be said of the painted coloured bowls. Wall fittings have their place in the showroom, and are tastefully arranged with a view to correct display. A "secret" light shown consists of an elliptical alabaster bowl with an oxidised silver rim, and gives a beautifully soft light. This is suitable for installing in the nooks usually found in houses of the Tudor or Elizabethan periods. Many kinds of glass shades for wall brackets are shown, including flambeaux, candelabra, and tinted and painted glassware. Some excellent examples of Japanese silk shades for lamp standards are exhibited, as well as standards in various woods and metal finishes. Floor standards, Tudor, Jacobean, Sheraton, &c., appear, and "outlets" are provided at intervals in the floor for plugging into to demonstrate these. There are "outlets" all over the place, making demonstration a very simple matter. The lights are wired in small groups, and the switching arrangements provide for the switching off of a group from the next switch plate in progress round the room, so that it is unnecessary to run back and switch off each time a new group is reached. The furniture is in harmony with the spirit of the display, the smaller exhibits being mounted on antique dark oak or mahogany tables. The display is, without doubt, worthy of a visit from those interested in the art of illumination.

Scottish Electricians' Strikes.—In many parts of Scotland electricians have come out on strike over a wages dispute, the National Conference in Edinburgh, on March 4th, having failed to reach a settlement. The employers are reducing the wages by 3d. an hour, making the wages 2s. an hour. In Aberdeen the position is complicated by the Union's action in bringing apprentices out, and it is stated the employers are to raise the question of the legality of this action. Public lighting is not affected, nor are shipyards or engineering works.

E.T.U. Conference.—The Electrical Trades Union will hold its annual conference in Blackpool during Whit-week.

Electrical Exhibitions.—Under the auspices of the municipal authorities, an electrical exhibition is to be held in the Town Hall, Aylesbury, from March 21st to 24th. Practical demonstrations of electrical cooking, heating, washing and cleaning will be carried out, and electric-lighting sets, electric vehicles and small farm plants will be shown in operation. Lectures upon electricity in the home and applied to agriculture are being arranged.

The municipality of Hereford is also contemplating the arrangement of a display of electrical apparatus, with an electrical *café*, &c.

The Lyons Fair.—At the Lyons Fair, which opened on March 1st, Great Britain heads the foreign representation with 115 stands. More than 60 firms are grouped by the Federation of British Industries. The Federation is giving a daily kinema show in which many British products are seen in process of manufacture.—*Daily Mail.*

The Fall in Metals and Australian Production.—Owing to the fall in the price of metals, the Queensland Government is closing down the Chillagoe silver, lead, and copper smelting works. Fifteen hundred employés are affected.—*The Times.*

New Italian Companies.—There has been formed at Borgosesia the Società Idroelletrica dell'Artogna with a capital of 3,000,000 lire, for the development of the hydro-electric industry.

The Società Impianto Elettrico has been embodied at Cagliari, with a capital of 300,000 lire, and offices at Sanluri.

The Stabilimento Italiano Lavorazione Elettrica Serramenti M. Bassi Janovitz has been established at Gorizia with a capital of 200,000 lire.

There has been constituted at Milan (Via Monte Napoleoni 39) the Società Italiana per l'Accumulazione Termoelettrica T.E.A. for the manufacture of economical electric cooking apparatus. Capital, 5,000,000 lire.

The Impresa Forniture Elettriche Ing. Beretta has been launched at Milan (Via Meravigli 7) for the manufacture of electrical machinery, with a capital of 300,000 lire.

The Società Elettrotecnica Ing. F.G. Pistorelli e Ca has been embodied at Padua for the construction and equipment of central stations. Capital, 400,000 lire.

At Varese has been formed, as a company, the Industria, Commercio, Applicazioni Termiche Elettriche, with a capital of 5,000,000 lire, for the equipment and carrying out of electro-thermic installations.

LIGHTING AND POWER NOTES.

Aldenham.—House Lighting.—The Watford Rural District Council has arranged to extend the lighting mains to supply electricity to houses at Aldenham, and to connect at the rate of £4 per house.

Australia.—Sydney (N.S.W.).—A keen controversy is taking place in Sydney as to whether a new turbo-alternator, required in connection with an extension of the city's electricity service, should be manufactured locally or imported from the United States. It has been shown that the Cockatoo works can manufacture the boilers and the turbine, and that they may possibly be able to make the greater part of the generator. The boilers made there for H.M.A.S. *Brisbane*, and other warships, are said to be of a similar type to those required by the City Council. The turbines made and installed in the ships were also much the same as the Council requires. Meanwhile the contract is in abeyance.—*Reuter's Trade Service* (Melbourne).

The Municipal Council has decided that it is inadvisable for the electrical engineer to join a conference of representatives of Government authorities and other suppliers of electricity to consider what form legislation should take to provide for the control of wholesale bulk power development and transmission within the State.

Bentley (Yorks.).—House Lighting.—The Doncaster Electricity Committee, after considering correspondence with the Bentley-with-Arksey Urban Council, has recommended (1):—That the Corporation undertake to supply electricity to the proposed houses at Arksey Lane at (*a*) a fixed rental of 1s. 3d. per week per house, plus 2d. for each unit metered; (*b*) that the charges in respect of the Victoria Road site be revised to correspond with the above-mentioned terms; and (2) that in the event of acceptance, application be made for sanction to borrow £6,205 for the provision of high- and low-pressure mains and transformer equipment for these purposes.

Bexhill.—Second-Hand Plant.—The Council has ascertained from the Electricity Commissioners that the shortage of electricity cannot be met for several years by the Government scheme or the Hastings scheme for bulk supply. It being, therefore, incumbent on the Council to provide the required generating plant, it was resolved to purchase a second-hand 500-kW Ballis-Dick, Kerr generating set from the Accrington Corporation for the sum of £3,800. The Council is advised that the plant should be good for at least 10 years.

Bideford (Devon).—Electricity Supply.—The Town Council has signed an agreement with Mr. S. L. Knill, of Barnstaple, for a supply of electricity for the town.

Birmingham.—Profit on Undertaking.—In the period April 1st to December 31st, 1920, the Birmingham electric supply department made a profit of £39,500. Of that surplus, £32,500 was realised during the December quarter, when local trade was fairly active; the six spring and summer months, with the comparatively small and broken load, realised but £7,000 profit. It was reported that since the New Year there had been a great falling-off in the consumption of electricity, due, of course, to trade depression, and, in view of present conditions, the Committee decided that it would be unwise to make any contribution to the relief of the rates, and the credit would be carried forward.—*Birmingham Post.*

Blackburn.—Proposed Sub-Station.—A Committee of the Town Council is inquiring into the question of erecting an electricity sub-station at Brownhill in connection with the generating station at Whitebirk, now approaching completion.

Disposal of Old Plant.—The Electricity Committee has authorised the electrical engineer to dispose of the older plant at Jubilee Street station, when no longer required.

Blackpool.—Smoke Nuisance.—At a meeting of the Town Council, complaints were made that soot from the electricity works was driving visitors away from the town. An undertaking was given that the nuisance would be abated.

Bolton.—Visit of Inspection.—The Electricity Committee has authorised the chairman and the electrical engineer to visit the works of the Escher, Wyss Co. for the purpose of witnessing the testing of the 12,000-kW turbine that is being manufactured for the Corporation.

Bradford.—Electricity Works Alterations.—Expenditure approved by the Corporation Advisory and Co-ordination Sub-Committee, covering a total for all Committees of £54,922, as a charge on capital account and revenue expenditure of £8,227, includes £19,557 for steel-work for alterations at the Bolton Road electricity works.

Braintree.—Electricity Supply.—The Urban District Council has signed an agreement with the East Anglian Electricity Co. for a public supply of electricity on the overhead system, at 11d. per unit for lighting and 4d. for heating, less 1d. for cash.

Burton-on-Trent.—Extension Scheme.—The Gas and Electricity Committee recommends the Corporation to approve a scheme for the extension of the electricity works, with a view to supplying the South Derbyshire district, subject to the consent of the Electricity Commissioners and the ability of the Finance Committee to raise the necessary funds.

Canada.—Central Stations.—Some interesting facts are contained in the part of the Census of Industry, 1918, dealing with central stations in Canada. The enormous preponderance of water power stations is clearly shown. The hydro-electric stations in the Dominion represent 91·4 per cent. of the total, and develop 1,682 191 h.p. Steam stations constitute 7·9 per cent., and gas and oil stations ·7 per cent., the total development being 1,841,114 h.p., or ·209 h.p. per head of population. The number of separate undertakings is 795, of which 418 are municipally owned; 515 of the undertakings are generating, and the remainder distributing. The total amount of capital sunk in the industry is given as $101,942,402. The number of persons engaged in central station and allied work is 9,696, representing an annual wage bill of $10,354,242. The revenue from the sale of power reaches a total of $53,549,133. The majority of the stations have capacities of less than 200 kVA—the actual number being 284. The rest of the stations are classified as follows:—200-500 kVA, 80; 500-1 000 kVA, 47; 1,000-2,000 kVA, 26; 2,000-5,000 kVA, 41; 5,000 kVA and over, 37.

Chile. — Hydro-Electric Developments. — Vast natural water-power resources in the central provinces of Chile are to be used for generating electricity for Santiago, Valparaiso, and neighbouring cities and towns. A company, capitalised at $3 250,000, has been formed for the purpose and work has already been started on a hydro-electric plant on the Colorado River, near Santiago, where it is expected 18,000 h.p. can be developed. The project is backed largely by Chilean capital. The motive for the promotion of the company was the need of more power by both the Valparaiso and Santiago tramways and by mining and industrial enterprises. Until recently no water-power concessions in Chile were granted by the President of the Republic for more than 35 years, but the latest concessions are said to be perpetual.—*Reuter's Trade Service* (Santiago).

Continental. — Holland. — In a recent issue the *Nieuwe Rotterdamsche Courant* states that, in accordance with the conditions of the contract for the supply of electricity to Stolwijk, Bergambacht, and Ammerstol by the municipality of Gouda, the latter has been requested to replace by underground cables the aerial network which is used at present. The costs have been estimated at 83,000 gulden, to which 7,000 gulden is to be added for a telephone cable of 14 km.

Italy.—The ambitious scheme of the Provincial Administration of Udine to extract the waters of the River Tagliamento and divert them into the Lake of Cavasso, in connection with a large hydro-electric station to be built there, has already passed the official scrutiny, and leave to begin the works is likely to be issued shortly. Equally favourable reception has also been accorded to the request for a concession of the waters of the Rivers Lumieci and Degano.

A concession has been granted to the Società per le Forze Idrauliche della Sila! to construct and utilise three reservoirs to be built on the upper courses of the Rivers Neto, Arvo, and Appollino, in the province of Cosenza, for the generation of electricity and for irrigation purposes. The power to be yielded by these plants is estimated at over 160,000 h.p., and the Government reserves the right to acquire energy at cost price for public purposes, and stipulates that within a year after the starting of the first central station, power to the extent of one-third of its output, and not less than 5,000 kW, is to be supplied to work the Calabro-Lucana railway. The construction and equipment of the reservoir with the necessary piping, &c., will represent a large engineering undertaking. The contents of the Arvo and Appollino reservoirs alone are estimated at 210,000,000 cb. metres. The equipment of the Appollino station will comprise seven generators of 12,500 h.p. each, reserve included, with exciters coupled, the machine hall having floor dimensions of 54 × 24 metres. The equipment of the Neto station will consist of eight generators of 14,700 h.p. each, including the reserve, and three 500-h.p. exciters, the machine hall having floor dimensions of 64 × 17 metres. The electric energy which these large undertakings will supply, when completed, is expected to benefit not only the province of Calabria, but the whole of southern Italy.

Luxembourg.—A general strike has been declared. All the factories in the mining district are at a standstill, and have been occupied by the military. The town of Luxembourg is without light. It is feared that the strike may extend to the railways.—*Reuter's Trade Service* (Luxembourg, March 3rd).

Finland.—A Committee appointed by the Government has reported in favour of a vote of credit of 10·5 millions of marks for the purpose of harnessing State waterfalls and the purchase of new falls. According to the present proposals, work is to begin at Imatra and Linnankoski, which are to be joined, and power generated from one station. During the present year certain expropriations are to be made for Linnankoski and a temporary power station erected at Imatra.—*Times Trade Supplement*.

Belgium.—Owing to the increasing demand for electricity for lighting and power purposes, the Société d'Electricité de l'Escaut, of Antwerp, is enlarging the capacity of its generating station at Merxem to 33,000 kW. The company has recently secured the concession for the supply of electricity to 13 more communes, including the town of Lierre, and is in negotiation with reference to a number of others.

Bosnia.—The Jugoslav Government has granted a concession for the establishment of a big electric central station in Bosnia. The station will be worked by the water of the Kovalschevo Polje, which will be led by a 10-km. channel to Tricana, where a fall of 245 metres will be arranged. It is estimated that 30,000 h.p. will be obtained.

Darwen.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £1,524 to extend electricity mains. The Council has approved the agreement for the supply by Blackburn Corporation of electricity in bulk to Darwen. The laying of mains has already been undertaken.

Dewsbury.—Bulk Supply.—Having entered into an agreement to buy electricity in bulk from the Yorkshire Electric Power Co., at a cost of £3,000 per year, the electricity department has installed new rotary converter plant to deal with this supply. The payment to the company is guaranteed for three years, irrespective of whether a supply is taken or not. The new plant, which has cost £7,000, comprises a sub-station, two transformers, two alternating-current rotary starting panels, two rotaries, and a direct-current switchboard. The plant will reduce the voltage of the supply from 10,000 to 450.

Dover.—Mains Extensions.—The Town Council has received sanction to a loan of £6,165 for mains. The mains are to be extended to St. Margaret's, at a cost of £4,000, to supply the village and the South Foreland lighthouse, and the authorities are asked to pay 10½d. per unit for the lighthouse supply of 1,500 units per annum.

Dublin.—Water-power Investigations.—A report of the Electricity Supply Committee to the Corporation states that recent investigations have definitely established that the River Liffey, if properly utilised, is probably capable of supplying all the present power requirements of Dublin and district and that the power passing to waste in the river averages 10,000 h.p. if spread uniformly over the 8,700 hours of the year. The Committee expresses the opinion that an eminent water-power engineer should be secured, at a fee not exceeding £1,000, to report fully on the possibilities.

Extended "Curfew" Order.—Military regulations extending the curfew to 9 (instead of 10) p.m., have not interfered with the public electric lighting, but early closing of shops—such as licensed premises—theatres, kinemas, and of the chief post-offices where counter-work is done, and the early retirement of private consumers, must necessarily have a serious effect on the consumption. Some important industries using electricity have abandoned nightwork altogether.

Dundee.—The Grampian Scheme.— Asked if it was not possible that the Town Council might get some share in the management of the company in the event of the Town Council taking power in bulk, Sir Henry Babington Smith (chairman of the Hydro-Electric Development Co.) said the company would welcome representation from Dundee if Dundee would contribute a share of the capital and take a share of the profits. They might participate in the provision of or provide the transmission line for carrying the power to Dundee.

Report on Loch Ericht Scheme.—The Corporation has received a report from Prof. Gibson, Manchester, and Major Richardson, the Corporation engineer, on methods for adding to the city's electricity supply, particularly by water power. Attention is called to the increasing demands upon the existing steam station, and the two practical ways in which hydro-electricity may be obtained, by developing the Ericht-Tummel scheme, or a part of it, or by purchase from the suggested Grampian Electricity Supply Co. If purchase from the company were decided upon, a definite contract would have to be entered into for supply at a lower price than that at which the city could produce it, and an adequate supply must be guaranteed. Failing this, the Corporation should consider developing the Ericht portion of the scheme alone, and this could be done for an approximate capital expenditure of £1,100,000. If this were worked in conjunction with the present steam station and the extensions proposed, the total supply would be at least 110 million units per annum, or fully four times the present output. The average cost would then be approximately 0·61d. per unit.

East Ham. — Estimated Deficit. — The borough treasurer has submitted a report to the Lighting Committee, upon the approximate position of the electricity undertaking for the nine months ended December 31st, 1920, showing an estimated net deficiency for the period of £11,780, which is accounted for by increases of war bonus, cost of coal, &c.

Electricity Districts.—West Riding (Aire and Calder) District Inquiry.—In pursuance of the provisional determination by the Electricity Commissioners of the above-named district they give notice that they will hold a local inquiry in the Civil Court, Town Hall, Leeds, on Tuesday, April 12th, 1921, at 10.30 a.m. and following days with reference to the area to be included in the proposed district, and the objections and representations which have been made, and to consider schemes which have been submitted by (*a*) the Corporation of Leeds; (*b*) a conference of West Riding local authorities; and (*c*) certain proposals by the Yorkshire Electric Power Co., for effecting an improvement of the existing organisation for the supply of electricity in the said district.

Copies of the respective schemes and proposals may be obtained from (*a*) Sir Robert Fox, Town Clerk, 11, Park Square, Leeds, at a cost of 5s each; (*b*) Mr. N. J. Fleming, solicitor to the Conference of West Riding Authorities, Town Clerk's Office, Bradford, at a cost of 5s each; and (*c*) the Secretary, the Yorkshire Electric Power Co., Wellington Road, Dewsbury, at a cost of 2s. 6d. each.

Copies of technical particulars in support of the said schemes and proposals can also be obtained at a reasonable charge on application at the addresses stated prior to the date of the inquiry.

Proposed Generating Station at Ferrybridge.—The Commissioners give further notice that they will at the same time inquire into an application made by the Yorkshire Electric Power Co. for the consent of the Commissioners under Sec. 11 of the Electricity (Supply) Act, 1919, to the establishment by the company of a new generating station at Ferrybridge.

London and Home Counties.—At a special meeting held on Tuesday, the Conference of local authorities owning electricity undertakings in Greater London, had before it a draft administrative scheme and also a proposed technical scheme. The Electricity Commissioners have fixed March 31st for the deposit of, and June 7th (provisionally) for the inquiry into, schemes for this area.

The engineering proposals have been drawn up for the conference by Mr. C. H. Wordingham, in conjunction with Mr. J. H. Rider, representing the London County Council, and Sir A. B. W. Kennedy and Mr. G. W. Partridge, representing nine of the principal supply companies within the area. Sir Philip Dawson also co-operated with regard to railway electrification and power demands. In preference to shutting down all existing local stations and taking the supply from new capital power stations erected on suitable sites, the committee recommends the retention and development of certain existing stations, the remainder being gradually shut down and new capital stations being established as required. It points out the improbability of any capital station being erected and made fully ready for work before the winter of 1925, and it proposes a scheme in two stages.

In the first stage 34 existing stations would be progressively shut down and supplied in bulk by means of interconnecting cables from the remainder. In the meantime the erection of four new capital stations would be started, three on the north side of the Thames, and one on the south side, on sites (three to the east of Blackwall Tunnel and one up-river).

As these stations became ready for work, the second stage would be reached, and 26 of the remaining stations would be progressively closed. Of the remaining 17 stations in the area two would be reconstructed and considerably enlarged to act as capital stations, seven would be permanently retained to act as auxiliary generating stations in conjunction with the new capital stations, and the remaining eight, near the outskirts of the area, would have to be kept at work for a considerable period to serve the local demands, until it became commercially practicable to extend the transmission mains to their neighbourhood.

The installed capacities of the capital stations would vary, in the first instance, between 70,000 and 200,000 kW, mostly in sets of 25,000 kW. Several of the sites would permit of much larger stations if required. The estimated capital expenditure by the Joint Electricity Authority for the first stage ending 1925-6 is £13,050,000, including the first portions of the capital stations with an installed capacity of 200,000 kW, and for the second stage ending 1930-31 at £30,750,000, including an installed capacity of 875,000 kW in the capital stations. These figures do not include the cost of acquiring existing generating stations or existing interconnecting mains.—*The Times.*

Ellesmere Port.—Electric Lighting Order.—The Council has been informed by the Electricity Commissioners, in connection with the Ellesmere Port and Whitby Electric Lighting Order, 1913, that in the event of an order being made authorising the Mersey Power Co. to supply electricity to the Wolverhampton Corrugated Iron Co., the order would contain the usual clause empowering the Council to take over the supply when it was able to give a supply to those premises; and with regard to the question of further time being required for carrying out the works under the Council's order, it was open to the Council to apply to the Ministry of Transport to postpone further consideration of the question of revoking the order beyond March 31st next.

Glasgow. — Inspection of London Lighting. — According to *The Times*, the Corporation is sending a deputation to London to investigate the newest systems of street lighting.

Glossop.— Public Lighting Contract.—The Town Council has accepted the tender of the Urban Electric Supply Co. for public lighting for a year.

Grampian Electricity Scheme.—Committee's Investigations.—The Perthshire Highland District Committee is asking the Highland Railway Co. to authorise the latter's engineer, Mr. Newlands, to go into the engineering proposals for the Grampian electricity scheme, particularly as to the sufficiency of the proposed dams at Loch Ericht. The Duke of Atholl says that certain stipulations as to the price at which electricity would be supplied to the district from Blair Atholl to Perth had been considered, but the distribution would require to be done by a private company or other combination as the promoters would only supply in bulk. The County Council is continuing negotiations with the promoters.

Guiseley and Yeadon (Yorks.).—Electricity Supply. —The Electrical Distribution of Yorkshire, Ltd., has received a special draft order from the Electricity Commissioners, under which it is intended to lay mains for the general supply of electricity within the urban districts of Guiseley and Yeadon within a period of two years after the commencement of operation of the order.

Hereford.—Extension of Supply.—The Town Council has entered into negotiations with a view to supplying electricity to coal-owners of the Forest of Dean, and numerous parishes *en route* will be supplied. A loan of £34,000 for the erection of a line to Ross and Lydbrook is to be applied for.

India.— Electricity in the Punjab.— A scheme, involving an estimated expenditure of about one crore of rupees, has been initiated by the Punjab Hydro-Electric and Industries Association of Delhi. The Association proposes to develop electrical power on four canal falls, and to connect them electrically so that power will always be available when any canal is closed.—*Reuter's Trade Service* (Bombay).

Kirkburton (Yorks.).—Electricity Supply.—When a letter was submitted to the District Council last week, from the Electrical Distribution of Yorkshire, Ltd., intimating its intention to apply for an order empowering the company to supply electricity within the district, and asking for approval, it was stated that the Council, at a previous meeting, had already agreed to support the application of the Huddersfield Corporation to supply the district.

Liverpool. — Extensions. — The Tramway, Electric Power, and Lighting Committee has approved of the extension of the l.p. mains from the static sub-station in Charles Street to the Liverpool Head Post Office, at an estimated cost of £2,083, and switchgear in connection therewith, at a cost of £150.

London.—Bethnal Green.—The Electricity Committee reports that the purchase of the "Oval Chapel" is about to be completed, and it has accordingly considered plans prepared by the borough engineer for the conversion of the building into an electricity sub-station. The borough engineer estimates the total cost of the works, including the cost of a travelling crane, to be £3,400.

Islington.—The Lighting Committee has presented a report which the borough treasurer has prepared upon the financial position of the electricity undertaking. This shows the capital expenditure to December 31st, 1920 (£627,966), the amount of loans paid off (£209,196), the amount of loans outstanding (£497,718), the amount of interest paid (£287,897), and the total commitments, including the above-mentioned capital expenditure (£836,048). The borough treasurer has dealt with the alleged over-capitalisation of the undertaking, and the Committee agrees with the conclusions at which he has arrived, viz., that the basis of capital cost per kilowatt shows that the undertaking is not over-capitalised, and that a comparison of the prices charged by Islington with those charged elsewhere supports this view. In the circumstances, the Committee does not consider there is any necessity for the Council to appoint a Special Committee, as was proposed.

Macclesfield. — Proposed Price Increase. — The Electricity Co. has signified its intention of applying for permission to increase its charges from 8d. to 1s. per unit. The Town Council is opposing the application, and calling upon the Ministry of Transport to hold a local inqiry into all the circumstances.

Middleton.—Loan.—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £46,000 to defray the cost of laying a cable and effecting sub-station alterations to enable an increased bulk supply of electricity to be given by the Manchester Corporation.

Newark.—Proposed Electricity Scheme.—Following upon a report by Mr. C. H. Wordingham, C.B.E., and a canvass of the inhabitants, it has been decided that the probable demand justifies the application for a provisional order. At a meeting of the Council the Mayor was asked if the possession of an order committed the Council to a scheme. The Mayor replied that during the past 20 years the Council had had two orders which they had not acted upon.

New Zealand.—Lake Coleridge.—It is hoped that the third pipe line will be completed by June next. By that time it is expected that the fifth generator, with a capacity of 3,000 kW, will have been installed, ready for use. When this generator is installed the capacity of the Lake Coleridge power house will be brought up to 9,000 k.W. The sixth generator, which will provide an additional 3,000 kW has been ordered. Specifications are ready for the fourth pipe line, but a contract has not yet been let. With the installation of the sixth generator and the fourth pipe line the total capacity will be brought up to 12,000 kW, the total aimed at when the scheme was originally formulated. It is noteworthy, as indicating how keen the demand is for electrical energy, that if the Lake Coleridge power house was at present capable of generating 12,000 kW, it would just about meet the total demands for North Canterbury. The works connected with the diversion of the Harper River into Lake Coleridge are progressing satisfactorily, and by May the waters of the Harper should be flowing into the lake in time to assist in keeping up the winter load.—*Auckland Weekly News.*

Horahora-Auckland Transmission Line.—The construction of a high-pressure line, at a cost of £150,000, from Horahora to Auckland, has been approved by the Cabinet. Asked when it was proposed that this work should be proceeded with, the Minister for Public Works, the Hon. J. G. Coates, said he hopsd that arrangements would be made for a start at the earliest possible moment. The whole question was contingent upon the Department being able satisfactorily to dispose of approximately 2,000 h.p. of electricity. When that had been arranged, he had authority to sanction the construction of the transmission line to Auckland.—*Reuter's Trade Service* (Melbourne).

Newcastle (N.S.W.).—Newcastle (N.S.W.) has been advanced the sum of £50,000 by the Commonwealth Bank of Australia for the purpose of installing an electrical plant. It is stated that exclusive of the demand for bulk power, there are 2,500 householders who would avail themselves of the opportunity of using electric light.—*Reuter's Trade Service* (Melbourne).

Tasmania.—Launceston.—The report of the city electrical engineer upon the electricity undertaking for the year ended June 30th last, records a total income of £40,847, and working expenses, &c., amounting to £26,963, leaving a gross profit of £13,884. This was distributed as follows:—Interest on loans, £9,204; sinking fund, £1,922; general account, £2,000; reserve fund, £758. The last two items represent the net profit, and compare with £2,010 in the previous year. During the year the connected load was increased by about 600 kW to 6,845 kW, while the maximum load reached 1,790 kW; the total plant capacity is 1,537 kW, including reserve.

Torquay.—New Station.—The question of a new electricity generating station was further discussed by Torquay Town Council on March 1st. Some of the members of the responsible Committee, becoming alarmed at the financial position of the authority, and the impossibility of securing a loan under 6½ or 6¾ per cent., carried a proposition that the matter should be delayed. The Council decided to secure expert opinion on the question of installing a new boiler.

Tynemouth.—Year's Working.—The annual report of the borough electrical engineer (Mr. C. Turnbull) for the past year, just issued, states that the units sold were 5,811,884, and the receipts £34,851, compared with 5,027,069 units, and £27,248, in 1919. The apparent loss upon the year was £293, compared with a profit of £224 for the preceding year; but the department spent out of revenue on mains, £605, and on meters, £576, so that the profit on the year's working was actually £888. The costs per unit sold (excluding three-phase, not sold through Corporation mains) were:—Generation, including bulk supply and wages, 0·743d.; distribution, 0·125d.; management and establishment expenses, 0·300d.; rates and taxes, 0·144d.; interest on loans, 0·216d.; sinking fund and redemption, 0·418d.; capital expenditure out of revenue, 0·113d.; total, 2·059d. The question of increasing the charges had been considered, but the Committee felt that it was desirable to keep them as low as possible, so that consumers would get the benefit. Even with the increased rates the charges were still far below those ruling in the majority of towns. The engineer notes that the output equals a yearly sale of 90·5 units per inhabitant.

United States.—Development of Niagara Falls.—The development of Niagara Falls water power as a national asset on a gigantic plan that would assign all water-power privileges to one individual or corporation, thus eliminating grants to various smaller interests, is urged in various recommendations now before the Federal Power Commission. Although agreeing generally that a comprehensive system of development should be adopted, the recommendations vary greatly as to the nature of the development. In approving any grants, the members of the present Commission, Messrs. Baker, Payne, and Meredith, are inclined to anticipate development of methods in the near future that will permit the economical transport of power to points 500 miles or more from the Falls. Experts have told the Commission that the "single assignment" plan should include assignment of water-power privileges below the Falls as well as those above. Plans to combine the several hundred thousand horse-power taken from the Gorge with the millions taken from above the Falls into one project were presented. The plans range from tunnelling under Goat Island, which hangs on the precipice between the American and Canadian Falls, to digging a power and ship canal from Lake Erie to Lake Ontario. Proponents of some of the schemes claim that the Government could tax such development to the extent of half a million dollars a year, and still give much cheaper power than at present, and leave a profit for the corporation on the investment. Mr. Baker, chairman of the Commission, has announced that no privileges anticipating future amendments to the existing water diversion treaty with Canada will be considered by the present Commission. Experts inform the Commission that 13,000 cb. ft. additional to the 20,000 now diverted on the American side could be taken from the Niagara River without marring the scenic beauty of the Falls.—*Reuter's Trade Service* (Washington).

Wallasey.—Price Increase.—The Wallasey Electricity Committee recommends the Council to increase the charges for electrical energy by ¼d. per unit for lighting, and by ¼d. per unit for power and heating.

Walton-on-Thames.—Price Increase Approved.—On condition that the rent of meters is not raised, and that the maximum charge for electricity is reduced to 1s. per unit, the Urban District Council has agreed not to oppose the application of the Urban Electric Supply Co. for leave to increase the present charge. The company's original application was for 1s. 2d. per unit.

Worksop.—Supply to Colliery.—The Urban District Council has made an agreement with the Wigan Coal and Iron Co., Ltd., for an additional supply of electricity to the company's Marton pit.

TRAMWAY AND RAILWAY NOTES.

Australia.—Perth.—Following on the award raising the tramway men's wages to the extent of £13,000 a year, the Government announces a revision of tramway fares. The first 1d. section fares from Perth Town Hall have been abolished, the rate being increased to 2d. For Sunday and holiday travelling an extra 1d. will be charged.—*Sydney Morning Herald.*

Toowoomba.—There is much comment in Toowoomba on the proposed tramway scheme. In his detailed report to the Toowoomba City Council, the consulting engineer estimates the cost of the tramway at £147,184. The cost of a transmission line, sub-stations, and apparatus, is £73,827, making a total estimated cost of £221,011.—*Brisbane Courier.*

Belfast.—Track Renewals.—The City Corporation has had under consideration a recommendation of the Tramway Committee to relay or repair 58 miles of permanent way at an estimated cost of £121,500, the work to be spread over a period of five years. Certain members of the Council were in favour of the work being carried out by direct labour. The general manager's recommendation was that the work be contracted for. Ultimately the matter was referred back to the Committee for reconsideration.

Bolton.—Track Renewals.—The Tramway Committee has decided to relay the track in Blackburn Road, from Halliwell Road junction to Dunscar Bridge, in Great Moor Street between Bradshawgate and Mawdsley Street, and also in Station Street.

Bradford.—Inspection of New Car.—The new double-deck railless car introduced by the Tramway Department is exciting interest in many parts of the country. The latest deputation to inspect the car was from Wigan, and intimations of a desire to pay visits have been received from the Tramway Committees of Glasgow, Oldham, and Southend.

Track Renewals.—The Corporation Advisory and Co-ordination Sub-Committee has approved, amongst other prospective expenditure, the recommendation of the Tramway Committee for track construction and renewals at Great Horton (two sections), Horton Park Avenue, and Wakefield Road, at a total cost of £31,184.

Chester.—Tramcars *v.* 'Buses.—It was stated at a recent meeting of the Council that the cost of bringing the track into proper order would be in the neighbourhood of £70,000. The only alternatives to this were the institution of a railless system or motor-'buses. Reports upon the whole condition of the tramways are to be prepared, dealing with both the working and financial sides of the question.

Continental.—Holland.—In the course of his memorandum in reply to the Preliminary Report of the Second Chamber on the Bill for the supply of electricity in Holland, the Minister of Public Works states that the result of an inquiry has convinced him of the desirability of combining the electrification of the whole railway system with the generation of electricity for other purposes, and that the general high-pressure system offers the greatest advantages. From every point of view, including cost of management, working expenses, and constant service, it was necessary that the industry should be controlled by the State. For this purpose it is proposed to establish the Nederlandsch Electriciteitsbedijf Limited Liability Co. at The Hague, with power to take over all existing power stations and organise a proper supply for the whole country. The capital of the company, which is given a 99 years' lease of life, will be Fl. 15,000,000 in 100 shares of Fl. 150,000, 51 of which will be held by the State. The board of management will consist of three members of Dutch nationality, appointed for five years at a general meeting of shareholders, whose decisions will be subject to the approval of the Minister of Public Works.—*Economic Review.*

Germany.—The electrification of the suburban lines from Berlin to Bernau and Hermsdorf has been commenced. A total length of 20½ miles is involved. For this purpose single-phase current at 15,000 volts and 16⅔ cycles has been selected; but at present current is to be generated as three-phase, the power being taken from an existing power house. Overhead catenary suspension with a span of 100 metres has been adopted. At Bernau, carriage sheds and workshops are being erected, and it is hoped to complete these within two years.—*Technical Review.*

Halifax.—Tramway Finance.—At a recent Town Council meeting, the Tramway Committee asked the Finance Committee to make provision in the next year's estimates for an amount equal to a 1s. rate, to cover any deficiency which the Tramway Department might have to face during the year, but the minute was deleted, as neither of the Committees had yet framed its estimates. The Tramway Committee also recommended application to the Ministry of Transport for power to borrow £243,222 for track renewals during the next three years, but the minute was referred back, on the ground that action should not be taken until after the appointment of the new tramway manager.

India.—Electric Headlights.—The principal railway companies of India are reported to be negotiating for the installation of the Pyle-National electric headlight, which throws a beam of light 3,000 ft. along the track.—*Reuter's Trade Service* (Bombay).

Liverpool.—Year's Working.—The report of the general manager of the Corporation tramways states that the total revenue for the year 1920 was £1,457,549, as against £1,207,229 in the previous period. Operating costs amounted to £1,386,522,

compared with £1,022,444, leaving a gross profit of £71,027 (£177,785). Capital charges absorbed £101,103 (£102,300), leaving a net deficit of £33,077, which compares very unfavourably with a profit of £75,485 in 1919. The reason given for the unsatisfactory result is the enormous increase of working costs which increased fares have failed to cover.

London.—Success of Fare-concession Scheme.—The London County Council Highways Committee, reporting upon the results obtained by allowing passengers to travel long distances for a fare of 2d. during the middle of the day, says that, while it is possible that receipts would have risen on account of the increased fares put into force last September, it is satisfied that the innovation has been of substantial financial benefit. There is no evidence to show that the increase of receipts during the slack hours has adversely affected receipts at other times, and it is reasonable to assume that some of those who are induced to travel by tramcar by reason of the introduction of the cheap mid-day fare return at times when the full fares are charged. As regards rush-hour traffic, there is still insufficient accommodation for passengers desiring to use the tramways; but although there has been a considerable increase in the number of passengers travelling at the cheap fares, there is still ample accommodation for more passengers in the mid-day cars.

A Tramcar "Queue".—Owing to a car fouling the points in Kennington Road, last week, cars were held up for a considerable period. A string of cars extended two miles from the scene of the accident along the Clapham Road; there was also another queue in the opposite direction.

Lincoln.—No Sunday Working.—A proposal to run tramcars and omnibuses on Sundays for three months, as an experiment, was not carried at a meeting of the City Council.

Tasmania.—Launceston.—The total income of the city tramways for the year ended June 30th last was £30,822, compared with £27,717 in the previous year. Working expenses amounted to £27,684, as against £22,380, leaving a gross profit of £3,138 (£5,337), plus £156 from maintenance account, making a total of £3,294. Capital charges absorbed £6,480, leaving a net deficit of £3,186, a considerable improvement on last year's debit balance of £617.

Stourbridge.—Proposed Conference on Fares.—The Town Council has decided to communicate with the Brierley Hill Urban District Council, stating that it is desirable that a conference of local authorities should be held to consider the question of tramway fares. This action has been taken as a result of the attitude of the Dudley-Stourbridge Electric Traction Co. in enforcing a minimum fare of 2d. on most of the sections.

West Ham.—Tramway Reconstruction.—The Tramways Committee recommends the expenditure of a total of £100,065 on the reconstruction of the tramway system, track renewals and cars. The proposals have been approved.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Wireless Telegraphy.—The Australian Government is sending a party of experts to the Willis Islands, with a view to reporting on the possibilities of establishing there a wireless telegraph station. This remote group of islands is 250 miles off the coast of Queensland, and it is thought that a station there would be of great assistance to the Government meteorologist in the preparation of his forecasts.

Germany.—Telephone Service.—A few months ago the German Postal Authorities introduced a condition that, apart from the annual rentals, each subscriber to the State telephone service must lodge a deposit of 1,000 marks. This compulsory loan, as it is now termed, has so far yielded 1,000,000,000 marks to the State, and is being utilised for extensions of the telephone system.

Poland.—Wireless Telegraphy.—The Polish Legation announces the signature of a million-dollar contract with the Radio Corporation of America involving the construction by the company of a large wireless station at Warsaw. The station and its 12,400 ft. steel towers will be capable of handling 200 words a minute. At the request of the Polish Government it has been arranged that the Corporation will operate the station for a term of years.—*Reuter's Trade Service* (Washington).

Telephone Message Recorder.—G.P.O. Tests.—Tests are about to be carried out at the G.P.O. of an invention by means of which, it is claimed, a permanent record of the conversation of the calling subscriber at the receiving end. On the 7th inst., the instrument was in process of being installed in the office of one of the chief officials of the telephone department, says the *Evening News*, who explained that matters were in a purely experimental stage. "Supposing the called subscriber is out of the room when the telephone bell rings, the message will be recorded on a cylinder. When the subscriber returns he places the receiver to his ear, turns a switch, allows a needle to run over the record, and the caller's conversation is repeated."

Telephone Service.—It is understood that Mr. Evelyn Cecil, M.P. for Aston, Birmingham, has accepted the chairmanship of the new Select Committee, which is to be appointed to inquire into the telephone service.

The Federation of British Industries has appointed a Committee to consider the question of giving evidence regarding the working of the telephone system before the Select Committee of the House of Commons.

The printing and paper costs of the first issue of the complete London and provincial telephone directories, produced at the Government printing works at Harrow, was £71,762, states Mr. Baldwin in Parliamentary papers. For subsequent issues, the cost will be approximately £48,900, says the *Birmingham Post*.

Mr. Pike Pease, Assistant P.M.G., in a recent speech at Merrow, admitted there had been inefficiency in the telephone service, and added that a large number of subscribers would be obliged to give up the telephone. It was impossible, he said, to hand over the telephones to a private company unless the telegraph service and post-offices went as well. The majority of exchanges were in post-offices, and it would be impossible to provide new exchanges in the rural districts from a financial point of view.

Sir Andrew Ogilvie, late Second Secretary of the Post Office, who was a member of the Departmental Committee on Telephone Rates and was closely connected during his official career with the telephone department, has been invited by the London Chamber of Commerce to join the Telephone Advisory Committee, on which, besides the Chamber, the Corporation, the London County Council, the Port of London Authority, the National Union of Manufacturers, &c., are represented, says the *Daily Telegraph*.

Mr. Illingworth, Postmaster-General, replying to a question in the House of Commons, said:—"The approximate number of telephone calls effected in the year ended March 31st, 1920, was about 850,000,000. Of these about 40 per cent. were made by existing flat-rate subscribers. About 50,000 of the present flat-rate users (including the £8 residence flat-rate) did not originate 2,000 calls per annum. It is estimated that, as regards 25 per cent. of the existing trunk calls, the new charge will be lower than the old. The number of calls in 1921-22 is roughly estimated at between 800,000,000 and 850,000,000. The additional staff required for registering calls and collecting charges under the new tariff is estimated to be 150, at an annual cost in salaries of £23,000."

Telephone Finance.—From the accounts of the telephone service for the year ending March 31st last, issued on February 15th, it appears that the total capital raised up that date amounted to £37,669,609, the annual charge in respect of which was £2,326 556. Capital expenditure in the 12 months totalled £2,634,242, bringing the aggregate up to £37,701,561.

The revenue account shows a total income of £9,232,063, compared with £10,462,832 in 1918-19, and expenditure amounting to £7,545,829, against £7,040,747. From the balance of £1,636,234 carried to net revenue account had to be deducted provision for depreciation, pension liability, and other charges, aggregating £3,698,015, and the net deficit for the year amounted to £1,961,710.

The accrued revenue for the year amounted to £8,119,323, compared with £6,746,500 in 1918-19. On the other hand, the value of services rendered to other Government Departments fell from £3,716,332 to £1,112,740, so that the gross receipts declined by £1,230,769 to £9,232,063.

On the telegraphs the deficit in 1919-20 was £2,636,183, so that the two services together incurred a loss of £4,597,893. As the balance of profit on the postal business amounted to only £3,469,828, there was, therefore, a net deficiency on the year's working of the Post Office of £1,128,065. This compares with a surplus in 1918-19 of £7,417,556.—*Daily Telegraph*.

New Exchange.—The new Langham public telephone exchange, situated at the Western District Post Office in Wimpole Street, W. 1, was opened on Saturday last. It will accommodate 1,900 subscribers' lines, and 1,300 lines were transferred from the Mayfair Exchange.

Telegraphic Errors.—The Postmaster-General disclaims liability for loss sustained in consequence of an error in a telegram. Such errors may involve business firms in serious losses, and the Federation of British Industries has invited its members to communicate with Head Office giving particulars of cases in point, with a view to making representations to the G.P.O. on the matter.

The Wireless Press.—Service Suspended.—The Wireless Press, a subsidiary organisation of the Marconi Co., which furnishes news by wireless telegraphy from foreign countries, will, on April 2nd, cease sending out its service of news. It is felt that the gathering of news should be performed independently of the "carrying" of it, says the *Daily Mail*.

United States.—Cable Dispute.—The controversy between the State Department and the Western Union Cable Co. relative to the laying of the Barbados-Miami cable came to a head on the 5th inst., when an American submarine-chaser open fire upon the cable ship engaged in connecting up the cable, which was already laid last summer, with the shore station. The incident took place four miles off Miami beach, where the cable ship had picked up the loose end of the cable attached to a buoy. The captain alleges that the cable ship disregarded his warning signals, whereupon the submarine-chaser opened fire. Work then promptly ceased, and the entire crew were arrested.—*Daily Telegraph*.

Wireless Telegraphy.—At Leafield, near Oxford, and Abu Zabal, near Cairo, the first two stations of the wireless Empire chain are being constructed, and according to the Assistant Postmaster-General, will be finished this summer.

Improvements in wireless telegraphy to ensure safety of life at sea were referred to by Senatore Marconi at the annual dinner of British shipmasters, held at Liverpool, on March 1st. The new system of direction-finding, which had not yet been applied anywhere, had been perfected, and Senatore Marconi believed it would do much more than ever was thought possible.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—April 19th. P.M.G. Telephone switchboards (Schedule No. 1.670).* (February 25th.)

April 27th. Victorian Railway Commissioners, Spencer Street. Caustic soda primary cells, complete (Contract No. 33.914).*

May 2nd. Victorian Railway Commissioners. Twelve miles of ·015 sq. in. two-core, lead-sheathed, wire armoured, 2,200-V cable.*

Brisbane.—March 30th. P.M.G.'s Department. Switchboard apparatus and parts.*

Ballinrobe.—March 15th. Ballinrobe Electricity Supply Co., Ltd. Erection of poles and overhead line in connection with the electric lighting supply. (March 4th.)

Batley.—Electric lighting installation at the Purlwell Store (No. 4) of the Batley Co-operative Society, Ltd. Particulars from the Secretary.

Belgium.—March 23rd. The Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Laying of the underground armoured cables required in connection with the supply of current to the Brussels-Haecht line. Particulars can be obtained for 3 francs from the Services Electriques, 48, Rue Montoyer, Brussels.

Belgrade.—May 1st. The Commercial Secretary to H.M. Legation at Belgrade has forwarded to the Department of Overseas Trade particulars of a call for tenders by the Serb, Croat, and Slovene Ministry of Public Works, for the erection of a power-station, main conductors and transforming stations in connection with an electrical scheme at Kostolac for the supply of energy to Belgrade, Semlin, &c. Tenders should be addressed to the Director, Ministry of Public Works, Belgrade. A translation of the specifition and conditions of tender, together with a plan showing the disposition of the various stations and lines, may be inspected at Room 48, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Dundee.—March 26th. Tramway Department. Twelve months' stores, including insulated wire, lamps, switches, and overhead equipment. The Manager.

France.—April 5th. The French State Railway authorities, 43, Rue de Rome, Paris. Supply of four 8-ton electric travelling cranes for the new railway workshops at Sotteville-Quatre-Mares, Rens. Particulars may be obtained from the Services Electriques (1st Division) at the above address.

Johannesburg.—March 30th. Municipal Council. Forty 50 h.p., 500 to 600-V tramcar motors. Tenders to Town Clerk, Municipal Offices, Johannesburg. A copy of the specification may be seen in Room 48 of the Department of Overseas Trade up to to-morrow (Saturday), after which date it will be available for loan to firms in the provinces.

London.—Hammersmith.—March 16th. Electricity Department. Erection of an overhead coal conveyor, brick chimney shaft and replating coal bunkers with steel sheeting. (See this issue.)

Macclesfield.—March 14th. Cheshire County Asylum, Parkside. Stores, including electrical goods, for six months. W. G. F. Tingay, Clerk.

Manchester.—April 7th. Electricity Committee. High-pressure steam and water valves; high-pressure steam and water pipes, steam receivers, &c.; weighbridges and automatic coal-weighing machines; electric and hand-operated cranes. (See this issue.)

Perth.—March 21st. Electricity Department. One 1,000-kW, d.c., geared turbo-generator, with condensing plant. (March 4th.)

Rhondda.—April 5th. Electricity Department. A.c. house service meters, cable, joint boxes, &c. (February 25th.)

Runcorn.—March 19th. Castner-Kellner Alkali Co., Ltd. Construction of light railway and sidings to connect their works with the L. & N.W. Rly. Co.'s Runcorn Dock branch. Lt.-Col. H. F. Stephens, engineer to the company, 23, Salford Terrace, Tonbridge, Kent.

Turton.—March 16th. Urban District Council. Electrical supplies. Particulars from Electrical Superintendent, Council Offices, Bromley Cross, near Bolton.

Uruguay.—Monte Video.—March 29th. State Power House. Single and three-phase meters.*

Wimbledon.—March 29th. Electricity Department. Annual contracts for cables and conduits, joint boxes and jointing materials, transformers, meters, &c., lubricating oils. (See this issue.)

Worksop.—April 6th. Electricity Committee. E.h.p. and l.p. cables; e.h.p. and l.p. switchgear; transformers; 500-kW rotary or motor converter. (See this issue.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1

CLOSED.

Algeria.—The Algerian Posts and Telegraphs have lately placed a contract with the Compagnie Française des Métaux, of Paris, for a quantity of high-conductivity copper wire, and with the Compagnie Générale d'Electricité, Paris, for bronze wire.

Australia.—Victoria.—With a view to relieving the pressing demand for power, the Victorian Electricity Commissioners have accepted a tender made by the Parsons Company for two turbo-generators, each of 15,000 kilowatts, at the price of approximately £100,000, to be shipped within eighteen months.—*Reuter's Trade Service* (Melbourne).

Bradford.—Tramways Committee. Recommended:—

Portable crane for tramway track renewal and construction work, £215.—John Smith (Keighley), Ltd.

Electricity Committee. Recommended:—

Steel reinforcement for foundations for No. 4 boiler-house at Valley Road generating station.—Expanded Metal Co., Ltd.

Escape pipes for safety valves for boilers at Valley Road Works.—Stewarts and Lloyds, Ltd.

Dartford.—Board of Guardians:—

Electric-light installation, Round House, and officers' quarters, £ E. E. Beaver; V. D. Ward, £68.

Gillingham (Kent).—Town Council:—

Two heads for Diesel engine, £180 each.—Mr. A. Coy.

Liverpool.—Tramways, Electric Supply and Lighting Committee. Accepted:—

Insulated cables and wires.—Liverpool Electric Cable Co.

Electric meters.—Landis & Gyr.

Stoneware troughing and insulators, &c.—J. Place & Sons, Ltd.; J. Bourne and Sons.

Brass and copper castings.—R. Roberts & Sons.

City Council. Accepted:—

Supply of cables and accessories for street mains and for stoneware troughing and insulators, &c.—Callender's Cable and Construction Co.

Spain.—The Spanish Government has just placed a contract with the Compagnie Française Thomson-Houston, of Paris, and the General Electric Co., of New York, for the electrification of the Pajares section of the Northern of Spain Railway.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Friday, March 11th. At the Philosophical Institute. At 8 p.m. Apprentices' night. Short papers on "Every-day Work" for the Society's prize.

Electro-Harmonic Society.—Friday, March 11th. At the Cannon Street Hotel (Grand Hall). At 8 p.m. Last smoking concert of the season.

Junior Institution of Engineers.—Friday, March 11th. At 39, Victoria Street, S.W. At 8 p.m. Lecturette: "Electrical Drive in the Cotton Trade," by Mr. A. T. McGuire.

Physical Society of London.—Friday, March 11th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Sixth Guthrie Lecture: "Some Recent Applications of Interference Methods," by Prof. A. A. Nicholson, University of Chicago.

Birmingham and District Electric Club.—Saturday, March 12th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Common-sense Methods of Recording Costing and Progress in Shop Management," by Mr. H. C. Young.

Royal Institution of Great Britain.—Saturday, March 12th. At Albemarle Street, W. At 3 p.m. Lecture on "Electricity and Matter," by Sir E. Rutherford, F.R.S. (Lecture II.)

Royal Society of Arts.—Monday, March 14th. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "X-Rays and their Industrial Applications," by Major G. W. C. Kaye. (Lecture II.)

Institute of Cost and Works Accountants.—Wednesday, March 16th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Lecture, "Some Observations on the Proposed Amendments of the Workmen's Compensation Act, 1906," by Mr. H. G. Simmons.

Paisley Association of Electrical Engineers.—Wednesday, March 16th At the Y.M.C.A., 25, High Street. At 7.30 p.m. Students' papers.

Illuminating Engineering Society.—Thursday, March 17th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Motor-car Headlights: Ideal Requirements and Practical Solutions," by Major A. Garrard.

Institution of Electrical Engineers.—Thursday, March 17th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Paper on "The Long-distance Telephone System of the United Kingdom," by Sir W. Noble.

Informal Meeting.—Monday, March 14th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Discussion on "Rectifiers." To be opened by Mr. R. L. Morrison.

Scottish Centre (Students' Section).—Friday, March 11th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "Machinery Operations in Automobile Construction," by Mr. R. J. Hird.

North-Eastern Centre.—Monday, March 14th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Discussion on the various regulations of the Board of Trade (now Electricity Commissioners) for electricity supply. To be opened by Mr. C. Vernier.

South-Midland Centre.—Wednesday, March 16th. At the University, Birmingham. At 7 p.m. Lecture, "Possibilities of Power Production," by Prof. F. W. Burstall.

Wireless Section.—Wednesday, March 16th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 6 p.m. Papers on "The Effect of Electron Emission on the Temperature and Anode of a Thermionic Valve," by Mr. G. Stead; and on "Some Thermionic Tube Circuits for Relaying and Measuring," by Miss W. A. Leyshon and Dr. W. H. Eccles.

Chelmsford Engineering Society.—Thursday, March 17th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Ball and Roller Bearings," by Mr. T. W. Cooper.

Manchester Wireless Society.—Thursday, March 17th. At the Manchester College of Technology, Sackville Street. At 7.30 p.m. Lecture on "Direction Finding," by Mr. J. Hollingsworth.

Institution of Mechanical Engineers.—Friday, March 18th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "Contact Pressures and Stresses," by Prof. E. G. Coker, F.R.S., Mr. K. C. Chakko and Mr. M. S. Ahmed.

NOTES.

E.P.E.A. Dinner.—The second annual dinner of the Newcastle and District Section of the Electrical Power Engineers' Association was held on March 2nd, Mr. A. W. Crompton presiding over an attendance of about 100. Occasion was taken to present to Mr. G. L. Porter a silver coffee pot and a gold watch in recognition of his services to the Association. Mr. Crompton, in making the presentation, said Mr. Porter took over the duties of secretary of the Divisional Council in 1918, and was divisional chairman in 1920. The membership was now 372. A musical programme followed the dinner.

The Curie Radium Fund.—It is announced from Paris that Madame Curie is to go to the U.S.A. in May, at the invitation of a group of prominent American women connected with the above-named fund, and that she is to receive as a gift from them of one gramme of radium.

To Relieve Congestion in Paris.—A proposal has been put forward to remedy the congestion of passenger traffic in Paris at busy hours of the day. M. Emile Desvaux has suggested to the Municipal Council, and his suggestion has been agreed to, that the possibilities of establishing an underground moving pavement should be discussed. This pavement would follow the line of the Grands Boulevards, which are not served by an underground railway; the public would be admitted in the same way as to a railway, by means of tickets, and the advantage of such an arrangement would be that it would never be necessary to wait for the "pavement," which would be moving all the time, and which would presumably be somewhat less crowded than the underground trains. The scheme was laid before the Municipal Council as early as 1900, by the inventor of a moving pathway, which was shown at the Exhibition, but it is considered that, in view of the many improvements which might be added, a competition should be held in order that the pathway may be provided with all the most modern devices.—*Reuter's Trade Service* (Paris).

Diesel-Electric Ship Propulsion.—The much-discussed Diesel electrically-driven freighter is to be given a trial through the conversion of the American steel ship *Fondonian*, owned by the American Mediterranean Steamship Co. The vessel, when the installation is completed, will be driven by an electric motor, the energy for which will be generated by power derived from two Diesel engines. It is estimated that the two engines, each developing 500 b.h.p will provide sufficient power to drive her loaded at a rate of nine knots.—*Reuter's Trade Service* (New York).

Ministry of Transport. — Mr. Bonar Law announced in the House of Commons on the 4th inst., that Sir Eric Geddes, Minister of Transport, was to retire from the Government at the end of August next. It is assumed in certain quarters that the Ministry of Transport is itself to be abolished at an early date.

Fire.—Damage to the extent of £2,000 was caused by a fire which broke out, on the night of February 25th, at the electrical engineering works of Messrs. Goodenough & Co., Barnstaple. The highly-inflammable character of some of the contents caused rapid and extensive destruction of a considerable quantity of motor materials.

Fatality.—An inquest was held at Birmingham on March 4th into the death of William Smith, of Saltley, who was employed as a works engineer by the Putney Rolling Mills Ltd. It was stated in the evidence that Smith went to attend to a transformer which required filling up with oil. Apparently he forgot to ensure that the power was cut off, and he came into contact with the terminals, receiving a shock at 3,000 volts. A verdict of "Accidental death" was returned.

Factory Lighting.—The Departmental (Home Office) Committee on Lighting of Factories and Workshops has now resumed its investigations. The Committee's work was temporarily abandoned after the publication of its First Report in 1915, owing to the war. The Committee is now constituted as follows:—

Mr. C. Dampier Whetham, F.R.S., chairman; Mr. Leon Gaster; Sir Richard Glazebrook, K.C.B., F.R.S.; Dr. C. S. Myers, C.B.E., F.R.S.; Mr. J. Herbert Parsons, C.B.E., F.R.C.S.; Prof. C. S. Sherrington, P.R.S., University of Oxford; Miss R. E. Squire, O.B.E.; Sir Arthur Whitelegge, K.C.B.; and Mr. D. R. Wilson, M.A.

The Committee will for the present restrict its inquiries to the following points:—(1) The conditions necessary to secure suitable lighting in factories and workshops; and (2) the effects of mixed natural and artificial lighting, with special reference to the lighting of underground workrooms.

The secretaries to the Committee are:—Mr. J. W. T. Walsh, M.A., M.Sc. (of the National Physical Laboratory, Teddington), and Mr. H. C. Weston, M.J.Inst.C. (Investigator to the Industrial Fatigue Research Board) to whom communications should be addressed at the offices of the Board, 6, John Street, Adelphi, W.C.2.—*The Times.*

Appointments Vacant.—Assistant inspector of wireless telegraphy for the Post Office (£275 +); plumber-jointer, for the Nelson Corporation Electricity Department. See our advertisement pages to-day.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Cannon Street Hotel, in the Grand Hall, on Friday, March 11th, commencing at 8 p.m. Chairman, Mr. Hugo Hirst. Artistes:—Mr. Sydney Pointer, tenor; Mr. Thomas Howell, bass; Mr. Fred Gregory, baritone; The Three Freds: Mr. Fred Gregory, Mr. Fred Gibson, Mr. Fred Wildon, humorous songs, phonofiddleoddities; Mr. Paul Brunet, violin; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Birmingham and District Electric Club.—The annual dinner of this club was held at the Grand Hotel, on Friday, March 4th, when about 100 members and friends enjoyed an excellent dinner and musical evening. Mr. H. C. Wynne, the president of the club, occupied the chair. In response to the toast of "The City of Birmingham," Mr. Chattock, chief of the City of Birmingham Electric Supply Department, expressed his confidence in the future of electricity supply in the city, notwithstanding the present financial stringency which had delayed their projected extensions.

Mr. McKenna on Taxation and Industry.—Speaking at a conference held under the auspices of the Industrial League and Council, Mr. McKenna said that in order to meet the high national expenditure heavy taxation was imposed. It was usually thought that all was well, provided the Government paid its way and raised in taxation all it spent. People believed the Government was only taking away from the consumer that which he would otherwise spend himself, but which the Government now spent for him. There never was a greater fallacy in the world. The great instrument of taxation in this country was the income-tax. The income-tax was 6s. in the £, and the 6s. was drawn not only from everybody's income, but from the whole of the profits earned by every business. Part of the profits of business should be put every year to a reserve fund. They would not be in a position to compete with foreign rivals unless a considerable part of the profits of business were put back in reserve in order to build up the industry. When the tax collector took money from business, it was largely taken from savings and spent on consumption, and they had in that increased expenditure on consumption, one of the strongest factors leading to high price. If his conclusions were right, it was really within the power of the nation to get stable prices, and if they got stable prices, they would then be able to sell abroad. The most urgent need of this country at the present moment was economy and efficiency. They could then have a good standard of living for the workman and real hope for the future. They must first re-establish their industry before they could begin their social reconstruction, and when they had done that, they would attain a much higher plane than they had ever reached yet.

Wireless Ship Control.—It is understood that in June, July, and August, exhaustive experiments will be made regarding the possibilities of wireless control of certain sea-going craft; such experiments have been more or less successfully carried out in the United States Navy. The old battleship *Agamemnon* will be fitted up as a target ship and equipped with a wireless installation, by which she will be manœuvred whilst guns and torpedoes in turn will work their will on her. Of course, the target ship will not be manned.

An Electrically Equipped Ship.—The s.s. *Somersetshire*, which has just been launched at the Queen's Island, Belfast (Messrs. Harland & Wolff's), is electrically fitted in every way. Her auxiliary engines, windlass, winches, patent steering gear, &c., will be electrically controlled, and the lighting will be of the latest and most powerful type.

Neon Lamps.—A new type of Neon lamp, with a consumption of five watts, has been brought out (says *Helios*) for purposes where lamps are only required for indicating or signalling, and the smallest size of metal filament lamp available for ordinary voltages has a greater consumption than is desirable. The lamps are stated to be very durable, and give a reddish light; even smaller sizes are made suitable for illuminated signs, &c.—*Technical Review.*

Photometric Errors.—According to an article by Mr. F. E Cady, of Nela Research Laboratory, in the *Electrical World* of February 12th, the error due to the selectivity or lack of whiteness of the paint, and the milk-glass window, of the Ulbricht sphere in comparing gasfilled with vacuum lamps is less than 5 per cent.

Electrically-Soldering Commutators. — A Canadian correspondent of the *Electrical World* says:—The difficulty usually encountered in soldering very large commutators may be diminished by heating the commutator connections with a small electric arc. An arc of approximately 5 amperes at 125 volts direct current has been found satisfactory for this purpose. The intensity of the arc can be regulated with an adjustable rheostat. For use in this process, an electrode holder has been constructed with an insulated handle. The electrode used is a carbon rod an arc-light carbon serving well. This holder is attached to a flexible lead which is connected to the positive side of the direct-current line. The negative connection is made by means of a bare wire wrapped two or three times around all the commutator bars. If the arc is regulated to the proper size, a very rapid and clean job is possible. Care should be taken not to use an arc so large that it will burn the risers. The use of such a method will eliminate much of the trouble usually encountered in soldering heavy connections to heavy strap conductors. Even with extra-heavy soldering irons of special shape, soldering large commutators is usually a very slow and tedious undertaking.

INSTITUTION NOTES.

Institution of Electrical Engineers. — Informal Meeting Section.—At the successful smoking concert on February 28th, at Anderton's Hotel, Mr. W. E. Bradshaw and his orchestra were highly appreciated. Individuals of the orchestra also gave solos, Mr. Le Roy with baritone songs; Mr. Hunt, violin solos; and Mr. R. Christmas, a most dexterous effort "The Ragtime Bass Player." Mr. Gill's tenor songs were encored, and Mr. Callieu and Mr. Harry Hearne provided some excellent humorous items. An unexpected treat was the conjuring display of Mr. Jardine Ellis, who was in the building, and kindly gave two short shows of his skill. Mr. F. Pooley was in the chair, and except when he was making a touching reference to the loss sustained by the Informal Section and engineering generally through the death of Mr. Rankin, all went very merrily.

Western Centre.—At a meeting of the Western Centre, held at Cardiff, on March 7th, congratulations were tendered to the joint hon. secretary (Mr. C. T. Allan) on his recovery from his recent illness. After the transaction of the routine business, Mr. W. T. Kerr, borough electrical engineer, Hereford, delivered a lecture entitled "The Prospects of Electricity in Agricultural Centres." The information imparted by Mr. Kerr came as a big surprise to those supply engineers whose activities are confined more or less to industrial centres. Mr. Kerr gave in extensive detail the lay-out of his system in Herefordshire and particulars of the various consumers connected. He enunciated the principle that the future welfare of the agricultural labourer depended on the utilisation by farmers of the acknowledged advantages which electricity gave over any other source of energy. The lighting of country residences, village public houses, and farm buildings secured prominence in the lecture and the comparative costs, both capital and working, of the electrical equipment in operation were very illuminating. He maintained that the food supply of the United Kingdom could be wholly home produced when electricity arrived at its proper place in agriculture. An active discussion followed the lecture, the feeling being expressed that a copy of the lecture should be in the hands of all supply engineers and the Ministry of Agriculture.

North-Eastern Students' Section.—On February 18th Mr. W. S. Kilner read a paper on the use of thermo-couples and resistance thermometers in connection with electrical machinery. The efficiencies of various couples were dealt with, and Mr. Kilner also raised the question of generator protection by means of thermo-couples. On February 25th this Section visited the Lemington Glass Works. The tour of the works was excellently organised by the secretary, Mr. M. Ryle, together with Mr. J. W. Ball, works engineer, and Mr. G. Barras, works manager. The latter gave a demonstration by making several very artistic ornaments, and showed a remarkable skill only to be attained by years of experience. In these works huge quantities of bulbs and tubing used in the manufacture of electric lamps were being made, both by hand and by machinery. A special point of interest was the automatic bulb-blowing machines.

Chelmsford Engineering Society.—On February 24th Mr. P. T. Harrison read a paper on "Engineering as Applied to Town Planning." Mr. Harrison laid stress on the importance of good roads, and said that, in his opinion, it ought not to be beyond the skill of the road engineer to construct roads suitable for carrying the new class of traffic, and that they must not wait for the transport engineer to design vehicles to suit the roads.

Diesel Engine Users' Association.—The first meeting this year of the Association since the election of its new president (Mr. C. O. Milton) was held on February 24th. A paper on "Oil-Engine Progress," by Mr. J. L. Chaloner, aroused considerable interest, and was followed by a useful and instructive discussion. The author referred in very favourable terms to the position of the British internal-combustion engine industry, and the lines on which it was likely to develop in relation to Continental and American competition. He gave figures in support of a statement that of the high-pressure engines in this country, 25 per cent. worked on the mechanical-injection principle, and that 50 per cent. were two-stroke engines. In the case of medium-pressure engines, 96 per cent. worked on the mechanical-injection principle, while 58 per cent. were two-stroke engines. He urged the imperative necessity of further flexibility on the part of the engines, in order that heavy-grade oils might be used to a greater extent.

Manchester Wireless Society.—At a general meeting, on March 2nd, Mr. E. Samuels was elected honorary secretary in the place of Mr. Y. W. P. Evans, retiring. The chairman (Mr. J. McKernan) paid a grateful tribute to Mr. Evans, whose work had placed the Society on a firm basis, and announced that, as some slight recognition, Mr. Evans had been elected an honorary member. Mr. R. Hallam (late wireless operator on the "R. 34") then delivered a highly-instructive discourse of "Workshop Hints as Applied to Wireless Telegraphy." The working and finishing of ebonite, the lacquering of brass, and the making of many small parts were all fully described.

Royal Institution.—"Severn Crossings and Tidal Power."—Lecturing before the Institution on the 4th inst. on the above subject, Mr. W. A. Tait, M.Inst.C.E., in referring to the proposed Severn barrage scheme, is reported by the *Birmingham Post* to have said that it would appear that the result which might be obtained was sufficiently promising to justify the Government in spending a considerable sum of money on investigation and experiments. The French Government, proceeded Mr. Tait, had prepared a scheme for the utilisation of 750,000 h.p. on the Rhine, and Britain need not shrink from a proposal for a 500,000-h.p. installation for a 10-hour working day on the Severn. Mr. Tait proposed that a suitable place for a trial would be Loch Seaforth, near Stornoway.

All-India Institution of Engineers.—The Viceroy has inaugurated the All-India Institution of Engineers, the full members of which are entitled to designate themselves "M.I.E. India." Among the speakers at the inauguration were the Earl of Ronaldshay, Sir Thomas Holland, Sir Thomas Callender, and Sir Rajendra Nath Mookerjee, first President. The Institution is all-embracing, for every branch of engineering throughout the whole country is represented.—*Morning Post.*

Institution of Production Engineers.—At a meeting held at Cannon Street Hotel, London, on February 26th, it was decided to form an Institution of Production Engineers. There was a large attendance when Mr. Honer, the convener of the meeting, opened the proceedings, and Mr. Cecil F. Hammond, of Coventry, was elected to the chair, and it was decided by a large majority to proceed with the formation of a separate Institution. A representative committee was appointed to draft rules, &c., and to report progress at a general meeting to be held on April 2nd. In the meantime, it is requested that all interested, particularly those who wish to become members, will communicate with the Hon. Secretary, Mr. A. T. Davey, 6, St. James's Square, Holland Park, Kensington, W. 11.

The British Electrical Development Association (Inc.)—At the adjourned general meeting of the Association, on March 4th, the new Council and Executive Committee were elected, as follows:—

President.—Mr. Hugo Hirst, M.I.E.E.

Vice-Presidents.—Messrs. Alderman Walker, A.M.I.E.E., and W. B. Woodhouse, M.I.E.E.

Members of the Council.

Messrs. C. H. Wordingham, C.B.E., *H. Hardie, and B. Welbourn. Representing I.E.E.

Messrs. *A. P. Ambler, C. O. Bastian, *A. F. Berry, *D. N. Dunlop, *W. A. Gillott, *H. C. Palmer, and A. E. du Pasquier. Representing B.E.A.M.A.

Messrs. *S. T. Allen, *F. Ayton, S. E. Britton, J. Christie, *A. C. Cramb, E. E. Hoadley, and *T. Roles. Representing I.M.E.A.

Messrs. *R. S. Downe and F. J. Walker. Representing Conference of Chief Officials of London E.S. Cos.

Messrs. *E. T. Ruthven-Murray and W. B. Woodhouse. Representing Inc. Association of Electric Power Cos.

*Mr. T. W. Cole. Representing Provincial Electric Supply Companies.

Messrs. *Ll. B. Atkinson and *W. F. Bishop. Representing the C.M.A.

Messrs. *J. E. Edgecombe, S. H. Callow, and *E. A. Marx. Representing E.L.M.A.

Messrs. *L. G. Tate, *H. Marryat, and S. H. Webb. Representing E.C.A.

* New Executive Committee.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

An official list of municipal employés' salaries, prepared on the instructions of the Southport Finance Committee, shows that in 1913 the salary of Mr. A. E. Black, borough electrical engineer, was £400, while to-day, in salary and bonus, he is receiving £726. This figure is the amount of salary and bonus being paid to the general manager of the electrical tramways, Mr. T. J. Kendrew, who, in 1913, was in receipt of £200, and the manager of the gas department, Mr. J. Bord, is now getting £1,341, as compared with £650 in 1913.

Watford Urban District Council has added £50 to the salary of the electrical engineer for February, and decided to fix the salary from March 1st at the rate of £850 per annum.

Mr. Walter White, who holds an engineering employment with the Western Electric Co., was married at Blackburn last week to Miss Gladys Peters. The presents included one from the employés of the above company.

Mr. A. J. S. Waddell, of Manchester, has been appointed generating engineer at Valley Road generating station, Bradford, at a salary of £500 per annum.

Halifax Tramways Sub-Committee, last week, reduced the number of applicants for the post of general manager from 26 to 6, who are to be interviewed by the full Tramways Committee.

Leeds Corporation has decided that the question of salary advances for all the higher-paid Corporation officials is to be postponed for six months. The decision affects all members of the various Corporation departments whose present salaries exceed £400 per year. The electrical officials concerned are Mr. J. B. Hamilton, tramways manager and city commercial manager (at present £2,530); Mr. C. N. Hefford, electrical engineer (£1,500); Mr. J. Burbridge, tramways electrical engineer (£780); and Mr. W. T. Green, assistant electrical manager (£760).

Obituary.—The death, on January 4th, of Herr Ernst Körting, head of the well-known firm of Körting Bros., gas engine builders, at the age of 89, is reported. The deceased founded his firm in 1871, in Hanover, and later opened branches and works in Vienna, Sestri Ponente, near Genoa, Buda-Pesth, and Moscow.

Lord Moulton, F.R.S.—We regret to learn that Lord Moulton passed away in his sleep on Tuesday night at the age of 77 years. During the day he had been engaged in a case at the House of Lords, and was in good health on retiring to rest. Lord Moulton was for many years, while at the Bar, greatly in demand for electrical and other patent and scientific cases in the High Courts. Subsequently he was made a judge. He was interested in electrical and chemical research, and during the war rendered valuable service to the nation in connection with high explosives.

Mr. Mortimer Evans.—*The Times* deaths column records the death of Mr. Mortimer Evans, M.Inst.C.E., F.G.S., M.I.E.E., F.R.A.S., which occurred in February.

Mr. G. H. Barlow.—The death occurred on March 3rd of Mr. George H. Barlow, electrical engineer, aged 36, a member of the staff of the Wigan Corporation electricity works.

Mr. E. Greek.—The death has taken place of Mr. Ebenezer Greek, late traffic superintendent on the Blackburn Corporation Tramways. He had been in the service of the department for 34 years, and was 52 years of age. About 70 of the tramway employés attended the funeral.

Wills.—The late **Mr. Walter Pitt**, chairman of Messrs. Stothert & Pitt, Ltd., of Bath, left £104,376.

The *Daily Telegraph* states that **Dr. Alexander Muirhead**, F.R.S., D.Sc., left estate of the gross value of £105,806, with net personalty £94,542. The testator left, on the death of his wife: £3,000 to the Royal Society of London for the general purposes of the society.

NEW COMPANIES REGISTERED.

Leeds Battery Co., Ltd. (173,325).—Private company. Registered February 23rd. Capital, £1,500 in £1 shares. To adopt an agreement with the Leeds Alliance Electrical Manufacturing Co., Ltd., and to carry on the business of manufacturers of and dealers in electrical batteries, fittings, and electrical accessories, &c. The first directors are: J. M. Firth, "Glenside," Holly Lane, Swinton; E. Hawkins, 151, Headingley Mount, Leeds; E. E. Barrett, Whitesmacks, Durham; C. E. Sheard, 2, Allerton Street, Kirkstall Road, Leeds; G. Higginbottom, 14a, Baxtergate, Doncaster. Qualification, £50. Secretary: E. Hawkins. Registered office: 44, Silver Royd Hill, Wortley, Leeds.

Electro-Freezers, Ltd. (11,635).—Private company. Registered in Edinburgh February 23rd. Capital, £1,000 in £1 shares. To carry on the business of engineers, &c. The first directors are: G. B. Arcari, 85, Thistle Street, Garnethill, Glasgow, engineer; T. M. Hunter, 45, Bishops Road, Jordanhill, Glasgow, engineer. Secretary (pro tem): T. M. Hunter. Registered office: 243, North Woodside Road, Glasgow.

Horsa Electrical Contracting Co., Ltd. (173,346).—Private company. Registered February 24th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, manufacturers of motors, engines, vehicles, and accessories, &c. The first directors are: H. T. C. F. Jalink, 112, Horsa Road, Erith, Kent; E. J. B. Bevan, 8a, Holly Hill Terrace, Erith, Kent; S. T. Weaver, 7a, Holly Hill Terrace, Erith, Kent. Secretary: S. T. Weaver. Registered office: 112, Horsa Road, Erith, Kent.

F. B. Hellon & Co., Ltd. (173,480).—Private company. Registered March 3rd. Capital, £4,000 in £1 shares. To carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The subscribers (each with one share) are: F. B. Hellon, St. Aubyn, Agnes Road, Blundellsands, Lancs., electrical engineer; E. J. Barker, The Cottage, Altcar Road, Formby, Lancs., electrical engineer. The first directors are: F. B. Hellon (chairman) and E. J. Barker. Solicitor: P. M. Quiggin, 8, Harrington Street, Liverpool.

Brierleys' Premier Welding Co., Ltd. (173,371).—Private company. Registered February 25th. Capital, £3,000 in £1 shares. To acquire the business carried on by W. Brierley and Mrs. F. Brierley at 140, Manor Street, Clapham, as the Premier Welding Co., and to carry on the business of electricians, general engineers, acetylene and electric welders, &c. The first directors are: W. Brierley, 2, Gauden Road, Clapham, S.W.; Florence Brierley, 2, Gauden Road, Clapham, S.W.; T. C. Evans, 2, Gauden Road, Clapham, S.W.; F. A. Broadey, Lion Lodge, Deepcar, near Sheffield. Solicitor: H. Watkins, 53, Haymarket, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Midland Electric Light & Power Co., Ltd.—Particulars of £30,000 debentures authorised January 17th, 1921; present issue, £20,000, charged on the company's undertaking and property, present and future, including uncalled capital.

Southern Brazil Electric Co., Ltd.—Particulars of £146,500 8 per cent. notes authorised January 19th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital, subject to £750,000 6 per cent. first mortgage debentures.

Electrical Contracts & Maintenance Co., Ltd. (101,757).—Return dated December 31st, 1920. Capital, £3,000 in £1 shares. All shares taken up. £1,331 paid, £1,669 considered as paid. Mortgages and charges: Nil.

City of London Electric Lighting Co., Ltd. (34,406).—Capital, £1,200,000 in 80,000 ordinary and 40,000 preference shares of £10 each. Return dated April 7th, 1920. 70,595 ordinary and 40,000 preference shares issued, £1,105,950 paid. Mortgages and charges: £800,000.

South African Lighting Association, Ltd.—Satisfaction to the extent of £24,550 on or before December 31st, 1920, of debentures dated July 24th, 1901, August 13th, 1908, securing £25,000.

Hexham & District Electric Supply Co., Ltd.—Particulars of £10,000 debentures authorised August 6th, 1920; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Leatherhead & District Electricity Co., Ltd.—Satisfaction in full on December 20th, 1920, of trust deed dated July 2nd, 1912, and supplemental deed dated June 30th, 1915, securing £25,000.

Steyning Electric Light Co., Ltd.—Deposit on February 18th, 1921, of deeds of Borough House, High Street, Steyning, to secure all moneys due or to become due from company to Barclays Bank.

Harland Engineering Co., Ltd.—Mortgage dated February 9th, 1921, to secure £4,000, charged on certain land and premises in Salford, Lancs. Holder: W. E. Ashworth, 13a, Rosamond Street, Salford.

Yorkshire (Woollen District) Electric Tramways, Ltd.—Issue on June 28th, 1911, of £50,000 debentures, part of a series (notified February 28th, 1921). Satisfaction in full on February 22nd, 1921, of debentures dated January 18th, and June 28th, 1911, securing £100,000 also notified.

Stols Electrophone Co. (1914), Ltd.—Mortgage debentures dated February 18th, 1921, to secure £5,000, charged on company's property, present and future, including uncalled capital. Holder: A. Hyman, 4-5, Copthall Court, E.C.

Hale, Pearn & Co., Ltd.—Two mortgages dated February 9th and 10th, 1921, to secure £6,000 and £2,000 respectively, charged on certain land in Manchester. Holders: Mrs. S. Benger, The Grange, Knutsford, Cheshire, and Mrs. E. Linney, The Limes, Denton, near Manchester.

M. L. Magneto Syndicate, Ltd.—Debenture dated February 23rd, 1921, to secure £80,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: R. L. Meats, 26, High Street, Coventry, and E. A. Raybould, 71-73, Edmund Street, Birmingham.

CITY NOTES.

Mather and Platt, Ltd.

Presiding at the annual meeting, held at Manchester on February 28th, the chairman, Mr. L. E. Mather, said that 1920 had been the best year in the history of the company. The increased profit was due to the larger volume of business transacted, and the percentage of profit on turnover was no greater in 1920 than in 1919. Though the available total was much larger they had considered it wise to recommend the same dividend and to increase the carry forward. The capital had been increased by 313,660 shares issued to the ordinary shareholders and the employés. With regard to the increased turnover, the tonnage output for the last six months of 1920 was 30 per cent. greater than for the similar period in 1913, the previous record year as regarded tonnage output. He took six months only because of the moulders' strike, which had had such a serious effect on the first half of 1920. They had made considerable extensions at Park Works, and had had to purchase premises in London for the use of the London and overseas organisation. While unemployment was so severe around them, the company had more men employed now than ever before in the life of the company. The moulders' strike compelled them to order considerable supplies of castings from abroad, and this had had a distinct effect on the present unemployment in many industries. In their own works the output per man, as far as they could judge, was practically up to the pre-war standard. There was a need for greater co-operation in industry. If they were to hold their own against foreign competition all sections of the community must pull together and cut out extravagance, waste, and restrictive measures, whether affecting labour, capital, Government, or trade as a whole.

Underground Electric Railways of London, Ltd.

Lord Ashfield took the chair at the annual meeting held on March 3rd. In his opening remarks, Lord Ashfield said that a loss of £55,000 had been incurred in the payment of the coupons on the 4½ per cent. bonds and the 6 per cent. income bonds, owing to the adverse exchanges upon New York and Amsterdam. He characterised as most unsatisfactory the fact that only £20,000 remained to carry forward after payment of dividends; the latter were also lower than in the previous year. The chairman reviewed the considerable progress made during the year. He outlined the main points of improvement embodied in the new rolling stock (which has been described in previous issues of the Electrical Review), and said that the car-mileage of the railways had increased by 7,340,000, while that of the 'buses rose 11,814,000 car miles, and the tramways 55,000. 1,487,000,000 passengers were carried by the group during 1920; this represented more than half the total traffic of the Metropolis. The increase in the number of passengers carried amounted to 110,000,000, or 8 per cent. In spite of these increases the financial result had been unsatisfactory, and the immediate cause was the absence of reasonable rates for passengers during the first nine months of the year. Lord Ashfield was pleased to announce, however, that since these revised fares had been put into force, affairs had assumed a brighter aspect. In the first three months of the year covered by the report the railways had carried 108,000,000 passengers, which brought in a revenue of £982,000. During the last quarter of the year, although the number of passengers fell to 98,000,000, the income amounted to £1,252,000. The same results were obtained from the tramcars and omnibuses. The chairman thought this indicated success, but the trade depression was having an adverse effect upon the number of passengers carried. Unless this phase passed the increased revenue from fares would only just balance the falling off in passengers. Fresh capital expenditure was needed, but before money was borrowed it was essential that the capital already invested should receive a fair return. The operating companies were financially independent, and it had been found that the withdrawal of the Government guarantee had been amply compensated for by the increased fares. The chairman said that the Associated Equipment Co. had not been so successful during the year, although the same dividend had been paid. In conclusion, Lord Ashfield referred to the negotiations with the L.C.C. and the Ministry of Transport

in connection with the co-ordination of the London traffic systems, and said he hoped for tangible and useful results. The Ministry of Transport railway grouping scheme was mentioned, and the speaker said that the group was an earnest of the acceptance of the principle in so far as the London railways were concerned.

Tramways, Light & Power Co., Ltd.

Presiding at the ordinary general meeting, held on March 1st, the Rt. Hon. Viscount Chilston, G.B.E., said that industrial disputes and the general trade depression had affected the company's revenue and delayed the completion of works under construction. Regarding the latter, he said that the new station on the Avon had been completed, and for the last three months had been supplying electricity to Warwick; the Leamington Spa district would soon be supplied from this station. A big industrial consumer whose annual bill would amount to about £30,000 was also about to be supplied from the Avon station. Considerable extensions had been carried out to the Hinckley station in the Leicestershire and Warwickshire Co.'s area. In the Derbyshire and Nottinghamshire area extensions had been kept down to a minimum in anticipation of a bulk supply from a proposed station on the Trent, but the high-pressure cable system had been extended considerably. In the opinion of the directors, the Government's scheme for the re-organisation of electricity supply could not succeed, and their opinion was derived from a study of the proceedings at recent inquiries held by the Electricity Commissioners. The directors deprecated the action of the Commissioners in withholding approval to the company's scheme for the erection of a large station on the Trent in favour of the Nottingham Corporation's proposals, although the Corporation had no statutory powers of supply outside its own boundary. The Commissioners' idea was that the company should receive a bulk supply, when available, from a station practically run by the Corporation. The Chairman said it would be agreed that municipal control and efficiency were not compatible. So far nothing had been done to commence operations upon the new station except a proposal to erect a small temporary station on the site. The Commissioners' action would result in many years of delay in meeting the requirements of this area.

The directors were confident that, unless unforeseen circumstances arose, there would be a substantial increase in the company's revenue during the current year.

The report and accounts were adopted unanimously.

Bournemouth and Poole Electricity Supply Co., Ltd.

Mr. J. A. Hosker, J.P., presiding at the annual meeting, said that the receipts from sale of energy and meter rentals had increased by £26,512, or 31 per cent. The total receipts on revenue account showed an increase of £28,978. The working costs amounted to £84,313, an increase of £23,792. Coal and other fuel showed an increase of £13,801, salaries and wages an increase of £4,200, repairs an increase of £1,662, and rates, taxes, and insurance an increase of £2,912. The total amount standing to the credit of the net revenue account, after adding the balance from last year and net profit on trading account, was £47,104, and the balance available for distribution was £22,549, as compared with £20,641 last year. They were paying the same dividend as last year, namely, 6 per cent. The figures could only be regarded as satisfactory, bearing in mind that they were still suffering from the abnormal conditions resulting from the war. Applications representing 1,942 kW had been obtained, as compared with 1,695 kW in the previous year, which was satisfactory having regard to the existing trade depression. The units consumed amounted to 6,198,302, as against 4,680,347 last year. The issue of 7½ per cent. 7-year notes was successfully made during the year. They succeeded in placing all they required, namely, £90,000, and he thought the company was to be congratulated on the success of that issue, having regard to the stringency of the money market when it was made and the fact that the market had declined steadily since.

Philips' Glow Lamp Works.

The report for 1920 of the N. V. Philips' Gloielampen Fabrieken, of Eindhoven, states that a portion of the new issue of ordinary shares has been taken up by the American group with which the company had concluded a community of interests. At the express wish of the group it had been decided to modify the articles of association so that only shareholders, with the exclusion of the other groups of participators in the profits, would have right to the reserves. In connection with this matter, it was also considered reasonable that those who were entitled to a percentage on the profits (the directors) should not suffer from possible large amounts being written off for depreciation and placed to reserve funds, and the method of profit distribution had been modified accordingly. The new group also urged that the profit-sharing certificates should be withdrawn, and the directors proposed to do so. Through the projected withdrawal of the profit certificates, which received 15 per cent. according to the articles of association, 10 per cent. in future would devolve upon the shareholders, and 5 per cent. on the directors, but the latter had expressed the wish to relinquish their rights in this respect in favour of the "*personnel* interests" which would in future consequently receive 15 instead of 10 per cent. of the profits.

Coming to consider more particularly the commercial side of the question, the report states that the directors took up an interest in various glow lamp works during the year. One of these manufactured too many other kinds of electrical articles, and had got into a less prosperous condition. The amount invested in the factory by the company had been for the most part written off, and the directors were acting so as to reorganise the business in such a manner that they would continue to be interested in it only in the manufacture of glow lamps, while the possibility existed that the factory would be able to be restored as a productive undertaking in the course of a few years. After dealing with the additions made to the dwellings provided for workpeople and officials, the report mentions that the bonuses payable to the *personnel* were again to be distributed half in cash and half in 6 per cent. cumulative preference shares issued at par.

The report proceeds to state that it is impossible to predict the future of the industry, especially in present times. From the technical point of view the directors were proud of sharing the leading position in the glow lamp industry, both in the old and the new world. As a result of the known community of interests the factories were mutually inspected, and patents and the latest inventions were interchanged. The company's sales organisation was again extended in 1920; but activity since the beginning of 1921 was suffering from the world crisis, and although it was possible to carry on at full output in January and February, the new orders received in these months were considerably less than in the corresponding period in 1920. The purchasing capacity of the whole world has declined, the public is reserved, and considerable stocks of lamps both at the company's branches and at customers abroad were lying in the stores. Nevertheless, the directors regard the future with confidence.

The working results for 1920 show profits of 10,150,000 fl., as compared with 11,208,000 fl. in 1919. It is proposed to write off 3,005,000 fl. for additional depreciation, and devote 750,000 fl. to the redemption of profit-sharing certificates, and to set aside 936,000 fl. for *personnel* interests, and apply 1,124,000 fl. as the directors' share in the profits. Out of the balance remaining the ordinary shares will receive a final dividend of 20 per cent., making 31 per cent. for the year, and the preference shares a final dividend of 4 per cent., making 11 per cent. for 1920. The dividend for 1919 was at the rate of 151 per cent. on the ordinary shares, of which 100 per cent. was paid in the new shares and 51 per cent. in cash, and 35 per cent. on the preference shares, of which 20 per cent. in ordinary shares and 15 per cent. in money. The ordinary share capital taken up now amounts to 10,200,000 fl., and the preference capital to 4,500,000 fl., as contrasted with 3,500,000 fl. and 2,250,000 fl. respectively a year ago.

Smithfield Markets Electric Supply Co., Ltd.

The annual general meeting of shareholders was held on February 25th. Sir Herbert S. Leon, Bart., who took the chair, said that the removal of Government control from the meat markets caused a revival of the pre-war competition among the tradesmen which reacted favourably upon the company's business. "Installation charges" paid by customers for alterations and extensions also added to the income of the company. The speaker could not say how the company would be affected by the London district electricity supply scheme, but the directors were carefully watching the progress of events in order to protect the interests of the shareholders should occasion arise. The output of the company was still increasing, and the prices charged were lower than those of other London companies.

The report and accounts were adopted, and the retiring director and auditors were re-elected.

Westminster Electric Supply Corporation, Ltd.

At the annual meeting, held on February 23rd, Capt. Edmund I. Bax (chairman) referred to the death of Lord Downham, the late chairman, and said that is was due to the latter that many objectionable clauses in the Electricity (Supply) Bill, 1919, were rejected. During the year nearly £60,000 had been spent on extensions of plant, mains, buildings, &c., and this sum would have been considerable larger if all the new plant on order had been delivered. Owing to this delay they had been unable to shut down the old steam plant at Eccleston Place and Davies Street to secure greater economy in working. The increase in revenue of £40,000 had been due only to the extent of £7,000 to increased charges. The units sold showed an increase of nearly 1,200,000. Special attention had been paid to the cooking and heating business of the company. The depreciation, sinking, and reserve funds now exceeded £562,000, and the financial position of the company could be considered very sound. Owing to the removal of lighting restrictions and the necessity of economising coal the business showed healthy signs of expansion, in spite of increased prices. Acting under the advice of Sir Alexander Kennedy, the board did not propose to erect any more generating machinery at the two stations mentioned above, and it was hoped to shut them down before the end of the year. The necessary new machinery and plant for the Central Co. was in course of erection at Grove Road, and consisted of two 10,000-kW turbo-generators, steam raising plant, and switchgear. The supply from this station would be brought to the company's sub-stations and distributed from there. In conclusion, the

chairman referred to the scheme of electricity supply prepared by the leading London companies for submission to the Electricity Commissioners. The scheme had been framed with a view to an extension of the tenures of the various undertakings.

Mr. Harold E. Young, referring to a former issue of shares to shareholders at a premium, hoped that this course would not be followed again, as it resulted in a loss to the shareholders, who were entitled to some advantage.

The chairman said he would bear the matter in mind in connection with any future issue.

The report and accounts were adopted.

Midland Electric Corporation for Power Distribution Ltd. Mr. James Taylor took the chair at the meeting held at Liverpool on February 28th. In presenting the report and accounts, the chairman said he considered the action of the directors in issuing £130,000 of ordinary shares in July last was wise in view of the present difficulty of obtaining money. The question of fresh plant was before the directors for, in spite of the trade depression, the demand for power was increasing. Referring to the delimitation of the Midlands into various electricity areas, the speaker said the company had protested against the separation of its area as had been suggested, and the position was being watched very closely. Some figures given indicated a steady growth in the strength of the company. In 1911 the gross revenue was £43,159, the net profit £2,500, and the number of units sold was 10,254,412. During the year under review these figures were £331,518, £83,278, and 38,341,675 respectively. The report and accounts were adopted, and the retiring director and auditors were re-elected.

Kensington & Knightsbridge Electric Lighting Co., Ltd. During 1920 the consumers increased by 228 to 5,637, and the connections (30 watt equivalent) by 38,519 to 641,738. Units sold 5,810,662. Net profit £16,344, plus £1,223 brought forward. After paying the preference dividends and 9 per cent. on the ordinary shares for the year, £2,617 is to be carried forward. The balance of the renewal and reserve fund now stands at £164,548. The report refers to the forthcoming electric supply legislation and the need for amendment.

Meeting: March 17th.

Newcastle-on-Tyne Electric Supply Co.—According to the *Financial Times*, Messrs. Lazard Bros. & Co. have purchased £500,000 4½ per cent. first mortgage debenture stock of the Newcastle-upon-Tyne Electric Supply Co. at 68.35 per cent., and they are offering their stock for sale at 69½ per cent., less a brokerage of ½ per cent. This £500,000 stock ranks *pari passu* in all respects with the existing stock, the total amount of which is limited to one-half of the amount of the share capital for the time being issued and fully paid up.

Para Electric Railways & Lighting Co., Ltd.—Gross receipts for the year ended November 30th were £296,897, and operating expenses £175,032; net revenue earned in Para, after allowing for loss on exchange, being £112,124. Transferred to depreciation and renewals reserve £10,000, to general and contingencies reserve £10,000. Preference dividend 6 per cent.; ordinary dividend 6 per cent.; carry forward £18,156.

Davis & Timmins, Ltd.—Dividend for the year 1920 8 per cent., and a bonus of 17 per cent., both free of tax. Carried forward, subject to special taxation, £53,535.

Electrical & Industrial Investment Co., Ltd.—A dividend of 6 per cent., less tax, for 1920 is announced on the preferred ordinary shares; £21,028 is carried forward, subject to corporation profits tax.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted:—

Armstrong (Sir W. G.), Whitworth & Co.—£2,000,000 6½ per cent. second debenture stock.

Vickers.—£1,500,000 7 per cent. 7-year notes, Nos. A1 to A4,000 (£100), B1 to B700 (£500), and C1 to C750 (£1,000).

Companies Struck off the Register.—The names of the undermentioned companies have been struck off the register, and such companies are therefore dissolved:—

Electric Wiring & Fittings Co., Ltd.

Radium Lamp, Ltd.

London Electric Wire Co. & Smiths, Ltd.—Final dividend on the ordinary shares making 7½ per cent., less tax, for 1920. £50,000 to reserve. Carried forward £38,926. Issued capital increased by final calls on new issue of preference shares.

County of London Electric Supply Co., Ltd.—Further dividend on fully-paid ordinary shares at rate of 11 per cent. per annum, less tax, making 8 per cent.; carry forward £18,594.

City of London Electric Lighting Co., Ltd.—Dividend (subject to tax) on the ordinary shares of 12 per cent. for the year 1920 and a bonus of 2 per cent. on account of reduction of dividend for 1916. £23,649 carried forward.

Telegraph Construction & Maintenance Co., Ltd.—The accounts for 1920 show net profit £110,187, plus £114,840 brought forward. Dividend 7½ per cent., free of tax, making 10 per cent. for the year. To reserve £20,000, carrying forward £115,388.

Notting Hill Electric Lighting Co., Ltd.—Expended on capital account during 1920 £19,791. The lamps connected (30 watt) increased from 280,087 to 303,188; profit increased from £31,225 to £33,816. The number of consumers is now 5,809, and all except 13 are supplied at 200 volts. There is put to depreciation, renewal, and reserve £3,000; to special reserve, £3,000; debenture interest, less tax, £1,792; Kensington & Notting Hill joint debenture stock interest and sinking funds, £4,292; income tax, £5,978; preference dividend 6 per cent., less tax; distributed to staff under co-partnership scheme £431; dividend on the ordinary shares at the rate of 8s. per share, less tax, £7,574; carried forward £3,647. Mr. R. G. Rawkins, manager and secretary, has been elected to the board in place of the late Sir William Crookes. Units generated or purchased 4,358,489; units sold 3,035,553. Meeting: March 15th.

Chelsea Electricity Supply Co., Ltd.—Profit for 1920 £41,874, plus £1,522 brought forward and £2,159 interest, making £45,555. Interest on debenture stock, £4,260; to reserve for renewals, depreciation, and contingencies, £17,312; written off cost of extinction of founders' shares, £4,178; written off investments, £2,925; 6 per cent. on preference shares; final dividend on ordinary shares at rate of 7 per cent. per annum, making 6 per cent. for the year, carrying forward £2,249. Units sold 4,916,128, an increase of 691,623. Meeting: March 16th.

Ward & Goldstone, Ltd.—Interim dividend at the rate of 7 per cent. per annum, less tax, will be posted to preference shareholders on March 31st.

Brazilian Traction, Light & Power Co.—A quarterly dividend of 1½ per cent. on the cumulative preference is announced.

STOCKS AND SHARES.

Tuesday Evening.

Remarkable rises occurred this week amongst Home Railway stocks, more especially those in the ordinary and deferred list. To name a precise explanation for the rally would be difficult. The simple reason, however, would appear to be the fact that prices last week got down to levels at which the fall certainly appeared to be overdone. Even in days like these, when there is so little money about, a certain proportion of capital can be trusted to become available for securities that are manifestly flat, and which require little buying for a complete change to be wrought in the aspect of the market. The Undergrounds, not having shared to the full extent in the previous slump of the steam stocks, have been left out of the recovery, and the changes on the week are downward. Underground income bonds are weak, and there is no recovery in either issue of the company, nor in Districts, Metropolitans and Central Londons.

Various reports have appeared from the Electricity Supply companies in respect of the year just ended, and most of them are decidedly satisfactory. The County of London report is a case in point. The company secured increases in most branches of revenue, and, although the working costs have also gone up, the result of the year's working is that the net revenue accounts gets £27,000 more than it did last year at £244,250. The increased dividend of 8 per cent. inaugurated last year is maintained, and £18,600 goes forward. The Metropolitan Electric Supply Co. shows an increase in gross revenue of £103,000, of which £7,000 was retained in net. The reserve has been increased to £615,000. The Notting Hill Co. shows a rise in net profit to £34,000, and the dividend on the ordinary is 8s. per share. Another interesting report is that of the Telegraph Construction Co. The meeting is due for Thursday in this week. Profits show a falling off of £14,000, but the company maintains its dividend of 10 per cent., free of tax (equal to 20 per cent. on the old capital), and puts the usual £20,000 to reserve, making the latter £160,000.

In the list of share prices, London Electrics have risen 5s. to £1, and Metropolitan preference are a good market at 2 13/16. On the other hand, Westminsters weakened to 4½, and once more the return is over 10 per cent. on the money. Metropolitans parted with half of their rise of the preceding week.

Manufacturing shares remain heavy. Edisons have fallen to 8s. 9d. English Electrics are weak at 12s. 6d. General Electrics fell 3s. to 20s. 9d. The reason for this decline is simply the fear of dividends being reduced, more or less substantially, in respect of the year just ended. There is a pretty general agreement that the 1919 distributions will certainly not be maintained, and, having regard to the all-round slump in trade, the question arises as to whether half the previous dividends will be paid in respect of the year just ended. These considerations affect the whole of the manufacturing group, and, indeed, industrials of every description in the Stock Exchange. Those who looked for settlement of commerce are disappointed at the turn which diplomatic affairs have taken. The occupation of German frontier towns does not promise hopefully for re-establishment of trading conditions with Germany, while the position in Russia, in spite of the lip-service paid to the idea of setting up a credit export scheme and the like, cannot disguise the extraordinary difficulties that still exist in the way of entering into trade relations with a country whose principal asset for the time being is the printing press.

Great Northern Telegraphs have gone back to 20½ owing to the movement of the French Exchange. Western Telegraphs are easier at 16 and Eastern ordinary at 160½. Chili Telephones went back to 5½. The general tendency of the market is not quite so good as it has been of late. Marconi's have been down to 1 21/32, rallying, however, to 1¾. Anglo-American issues are quiet, and there is nothing of fresh consequence in other cable stocks.

Amongst foreign issues, Brazilian Tractions have given way to 36½, and Mexico Trams 6 per cent. bonds to 23½. Mexican Light and Power first mortgage bonds are lower at 62½. There is neither interest nor support for Mexicans at the present time, and the failure of the Mexican Government to provide the monthly remittances promised to the Mexican Railway Company is exercising the minds of those who had pinned their faith to the power of the new President to start an era of progress and prosperity. Argentines are quiet, and amongst dollar stocks the tendency during the past week has been irregular. Shawinigan Water at 115½ and Canadian Generals at 126½ are both lower. Toronto Power debenture has risen 4 to 76.

North Metropolitan 5 per cent. debenture hardened to 57½. Tees Power Sixes at 89 are a point lower. The market in iron, coal and armament shares is despondent. Vickers ordinary and the 5 per cent. tax-free preference are dull at 10s. 7½d. and 11s. 3d. respectively. Rubber market conditions are practically unchanged. Leading shares are again lower on the obvious impossibility of producing companies making anything but a loss while rubber rests at a shilling or so per lb.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1919,	Dividend 1920.	Price March 8, 1921.	Rise or fall.	Yield p.c.*
Brompton Ordinary	12	12	6½	—	£9 16 0
Charing Cross Ordinary	7	8	3½	—	10 6
do. do. do. 4½ Pref. ..	4½	4½	2½	—	8 3 8
Chelsea..	4	6	3½	—	9 10 6
City of London	13	14	25/-	—	11 4 0
do. do. 6 per cent. Pref. ..	6	6	17/6	—	6 17 2
County of London	8	8	7½	—	10 9 10
do. do. 6 per cent. Pref.	6	6	5½	—	7 5 5
Kensington Ordinary	7	9	4	—	11 5 0
London Electric	2½	5½	1	+ ¼	7 10 0
do. do. 6 per cent. Pref...	6	6	3¾xd	—	10 18 2
Metropolitan..	6	7	3½	— ¼	11 8 6
do. 4½ per cent. Pref. ..	4½	4½	2½	— ¼	8 15 8
St. James' and Pall Mall ..	12	12	6	—	10 0 0
South London	6	—	2½	—	9 2 10
South Metropolitan Pref. ..	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	4½	— ¼	10 5 2

Telegraphs and Telephones.

	1918	1919			
Anglo-Am. Tel. Pref.	6	6	83½	—	7 9 3
do. Def.	33/6	1½	16½	—	9 6 6
Chile Telephone	8	6	5½	— ¼	*5 6 8
Cuba Sub. Ord.	7	7	6½	—	*10 18 4
Eastern Extension	10	10	12½	..	*6 6 0
Eastern Tel. Ord.	8	10	160½	—1	*8 4 7
Globe Tel. and T. Ord.	8	10	12½	—	*6 6 0
do. do. Pref.	6	6	9	—	6 18 4
Great Northern Tel.	22	22	20½	— 1	10 14 8
Indo-European	18	10	80	—	8 6 8
Marconi	25	25	1¾	— A	—
Oriental Telephone Ord.	10	12	2⅞	—	*5 9 7
United R. Plate Tel.	8	8	6½	—	*6 8 0
West India and Panama	1/3	Nil	⅞	—	Nil
Western Telegraph..	8	10	16	— ½	*6 5 0

Home Rails.

	1919	1920			
Central London Ord. Assented ..	4	4	43½	—	9 4 0
Mesropolitan	1½	1½	20½	+ ½	7 6 4
do. District	Nil	Nil	13½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A" ..	Nil	Nil	5/-	— 6d.	Nil
do. do. Income ..	4	2	65½	— 2	2 19 8

Foreign Trams, &c.

	1918	1919			
Anglo-Arg. Trams, First Pref. ..	Nil	5½	28	—	10 9 6
do. do. 2nd Pref. ..	Nil	Nil	8½	—	Nil
do. do. 5 % Deb. ..	5	5	60½	—	8 5 0
Brazil Tractions	Nil	Nil	36½	—1	Nil
British Columbia Elec. Rly. Pfcs.	5	5	56	—	8 18 6
do. do. Preferred	2½	5	53½	—	*8 16 0
do. do. Deferred	Nil	3	50½	+2	*11 18 2
do. do. Deb. ..	4½	4½	57½	—	7 10 0
Mexico Trams 5 per cent. Bonds..	Nil	Nil	39	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	23½	—1	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	18	—	Nil
do. 1st Bonds	Nil	Nil	62½	—1	Nil

Manufacturing Companies.

Babcock & Wilcox	15	15	9½	—	*7 1 2
British Aluminium Ord.	10	10	17/-	—	11 15 4
British Insulated Ord.	12½	15	13	—	9 5 10
Callenders	25	15	14	—	10 18 2
,, 6½ Pref.	6½	6½	17/6	—	7 8 7
Castner-Kellner	20	17	21	—	7 12 9
Crompton Ord.	10	10	13/9	—	14 11 0
Edison-Swan	10	10	8/9	— ½	—
do. do. 5 per cent. Deb. ..	5	5	70	—	7 2 10
Electric Construction	10	10	15/9	—	12 14 0
English Electric	—	8	12/6	—6d.	12 16 0
Do. Pref.	—	6	13/6	—	8 17 10
Gen. Elec. Pref.	6½	6½	18/6	—	7 2 6
do. Ord.	10	10	1-½	— ½	*9 13 8
Henley	25	15	14	— ½	10 18 2
do. 4½ Pref..	4½	4½	3¾xd	—	6 18 6
India-Rubber..	10	10	6	—	—
Met.-Vickers Pref.	—	8	14½	—	8 16 4
Siemens Ord...	10	10	8½	—	*10 6 2
Telegraph Con.	20	20	21½	—	*5 11 3

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Tuesday, March 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	11d.	3d. dec.
a Ammoniac Sal	per ton	£75	£27 dec.
a Ammonia, Muriate (large crystal)	,,	£65	£8 dec.
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£58	...
a Copper Sulphate	,,	£35	...
a Potash, Chlorate	per lb.	7d.	...
a ,, Perchlorate	,,	10d.	...
a Shellac	per cwt.	£16	...
a Sulphate of Magnesia	per ton	£16	...
a Sulphur, Sublimed Flowers ...	,,	£31	£1 dec.
a ,, Lump	,,	£18	...
a Soda, Chlorate	per lb.	4½d.	...
a ,, Crystals	per ton	£7	...
a Sodium Bichromate, casks ...	per lb.	1½	...
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0	½d. dec.
c ,, Tubes (solid drawn)... ...	,,	1/1½ to 1/2	½d. dec.
c ,, Wire, basis	,,	1/0½	½d. dec.
c Copper Tubes (solid drawn) ...	,,	1/3½	1d. dec.
c ,, Bars (best selected) ...	per ton	£116	£4 dec.
c ,, Sheet	,,	£116	£4 dec.
c ,, Rod	,,	£116	£4 dec.
d ,, (Electrolytic) Bars ...	,,	£74	£7 dec.
d ,, ,, Sheets ...	,,	£148	...
d ,, ,, Wire Rods..	,,	£88	£7 dec.
d ,, ,, H.C. Wire ..	per lb.	11½d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/9	...
h Gutta-percha, fine	,,	14/- to 16/-	...
h India-rubber, Para fine	,,	11½d.	...
i Iron Pig (Cleveland Warrants) ...	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£45	£5 dec.
g Lead, English Pig	,,	£19 10s.	25/- dec.
g Mercury	per bot.	£12 10 to £12 15	...
e Mica (in original cases) small ...	per lb.	4d. to 4/-	2d. to 4d. dec.
e ,, ,, ,, medium ..	,,	5/- to 10/-	...
e ,, ,, ,, large ...	,,	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings	,,	1/4 to 1/9	1d. dec.
p ,, ,, rolled bars and rods	,,	2/4 to 2/7	...
p ,, ,, rolled strip & sheet	,,	2/4 to 2/8	...
d Silicium Bronze Wire	per lb.	1/4	...
r Steel, Magnet, in bars	,,	1/8	...
n Tin, Block (English)	per ton	£148	£15 to £17 dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/6	...
p White Anti-friction Metals ...	per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

The Peltier Effect and Low-Temperature Research.—In a letter under this heading in *Nature* of February 24th, Mr. A. A. Campbell-Swinton inquires whether the Peltier effect has ever been considered as an aid to the production of very low temperatures. The lowest temperatures yet obtained are those produced by Dr. H. K. Onnes, of Leyden, who, by reducing the temperature of metals to that of liquid helium, has got down to within less than 4° of the absolute zero of temperature, or more than 450° below zero Fahrenheit. Onnes, moreover, found that at such a temperature pure metals lose practically all electrical resistance, and become nearly perfect conductors. Mr. Swinton's suggestion is to apply the Peltier effect, which consists in an observed diminution in temperature when an electric current is passed in a particular direction through a thermo-couple, to obtain still lower temperatures. At ordinary temperatures, when the metals composing the thermo-couple have appreciable resistance, the Peltier effect is largely masked by the C^2R heat produced in the metals by the passage of the current. At the temperatures attained by Onnes, when resistance practically vanishes, this condition should not obtain, with the result that the application of the Peltier effect would appear to give possibilities of obtaining materially lower temperatures than have yet been reached.

Electric Cooking at Ilford.—The electrical engineer reports that in consequence of statements made at a Council meeting recently with regard to the electric cooker at the fire station, he has investigated the matter and finds the following are the facts:—The cooker in question is an old "Tricity" oven fitted with new elements. In addition there are two boiling plates in use, these being the property of the consumer. The energy consumption for the September quarter was 549 units, the cost of which amounted to £9 3s. (not £15 as stated), and for the December quarter, 411 units, or £6 17s. From December 20th to February 1st, only 44 units were used. "There is no doubt that during the two quarters referred to the whole of the cooking has been done electrically. It has been conclusively proved that when care and common sense are used, electricity can compete very favourably with gas for cooking."

THE ELECTRICAL FUTURE OF NORWAY.

Though trading prospects in Norway are rightly described by H.M. Commercial Secretary as gloomy, there is much in the future of the country which will prove of interest to the electrical engineer. In his view, as expressed in his report on the industrial and economic situation of Norway in December, 1920 (Cmd. 1145), it is improbable that trade will recover and approach normal dimensions until an outlet has been found, either at home or by re-export abroad, for the accumulation of imports which has been piling up for many months. Even then, if the country is to make a good recovery, strict economy, hard work, and social and industrial peace are essential. Labour in general in Norway, as in Great Britain, does not yet appear to have arrived at a clear understanding of the situation, but it cannot be doubted that rapidly increasing unemployment has opened the eyes of many workers to the precarious state of affairs.

Owing to general industrial stagnation, the demand for machinery, machine tools, belting, &c., is very slack. German firms are making great efforts to recover their market in Norway for machinery and tools, and are able to undersell all competitors in this class of goods. Several large German exporting firms have now sales offices in Christiania.

German Competition.

Unless the rate for sterling and dollars falls, such business as can be done is likely to be secured by countries whose currency is not at a premium, particularly Germany. The latter country, besides being in a position to undersell all competitors, appears to be able also to offer quicker delivery of electrical machinery, turbines, machine tools, &c.

In fact, in electrical machinery, German firms have re-established their position in the Norwegian market, and an expert estimates that they have secured 25 per cent. of the business in all kinds of such apparatus. Imports from the United Kingdom are stated to have remained small, owing to the fact that British manufacturers have been in a position to obtain a sufficiency of work which pays them better than deliveries to Norway. In the case of cables British exporters have secured a fair share of the business, which has been considerable.

At the present moment the demand in Norway has relaxed owing to the stringency of the money market. It is, however, the opinion of an expert that the rapid development will not be retarded long. He bases his opinion on the following factors: It is estimated that about 1,300,000 h.p. generator capacity has been installed in the country, and available figures appear to indicate that a large proportion of this power still remains to be disposed of among consumers. There will, therefore, necessarily continue to be a large demand for cables and smaller kinds of machinery such as transformers, motors, and cooking and heating apparatus. The use of electricity for cooking and heating has increased very greatly owing to the high cost of coal, and there is a great future for cooking and heating apparatus.

It is, however, obvious that the exploitation of water power, whether harnessed or unharnessed, must depend very considerably upon the position of the money market and the possibility of raising the requisite capital.

The Commission appointed by the Storthing in 1918 to inquire into the question of a national plan for the supply of electricity for the whole of Norway has not yet submitted any recommendation, being still engaged upon technical preparatory work.

The new administration of electricity came into force on January 1st, 1921, when an Electricity Board of nine persons took over the daily conduct of affairs. The Board consists of one director-general, with three expert sub-directors working under him, one in charge of questions concerning watercourses, the second in charge of waterfalls, and the third in charge of electricity, while the remaining five members of the Board will be representatives chosen by the Storting.

Municipal Power Schemes.

The completion of municipal power schemes has been hampered considerably by the stringency of the money market, which has rendered it difficult to raise the necessary funds. Only a few new municipal power schemes have been initiated during the past year, viz., the following:—

The municipality of Drammen, having completed the extension of the Labro power station, which was under construction last year, is now considering a further extension of the same power station for the production of an additional 3,600 kW. The Bergen municipality is considering the question of procuring 6,000 kW from the Herlandsfos.

The Christiania municipality, which is badly in want of power, has received the offer of 12,000 kW from Rjukan, and also an offer of 20,000 to 60,000 kW from Tysse. In the event of its accepting the offer of power from Tysse the transmission voltage would be 150,000. In discussing the desirability of accepting this offer, the Christiania municipality has to take into consideration the comparative advantages to be obtained from the harnessing of the Raanaasfos and Solbergfos (see below).

The following municipal power schemes have lately been completed:—

Honefos and Norderhov have completed the installation of 8,000 h.p. at Honefos Mill. The town of Haugesund has completed the harnessing of the Etne watercourse. The town of Christiansund N. has completed the harnessing of the Skar watercourse. The Vaagsfjord Power Co. has completed the harnessing of a small watercourse for the supply of power to the Troms county.

The following municipal schemes are still being proceeded with, but are hampered by financial difficulties:—

That of the town of Fredrikshald for power stations on the Brekke and Krappeto waterfalls. The harnessing of Faslefos at Bægna. The scheme of the Nord Tröndelag county for harnessing the Folla watercourse. It is anticipated that the originators of this scheme will have difficulty in disposing of the 30,000 h.p. which it is estimated to produce.

Work has proceeded on the harnessing of the Raanaas waterfall on the river Glommen, and it is expected that 24,000 h.p. will be ready for delivery in the course of next year. The dam has been completed, and work upon the power station has commenced. In the case of the Hoge Waterfalls, purchased by Aust Agder county, the construction of the power house has been completed, the transmission line is being erected, and transformers are in process of installation.

Work is proceeding on the scheme of the Kristianssand town for the harnessing of the Nomeland fall, which is expected to yield 16,000 h.p. One generator, yielding 11,000 h.p., is now working. The work on the Tafjord watercourse has been continued, and the scheme is now partly in operation. The work on the Aalfot watercourse has been suspended owing to financial difficulties.

Government Power Schemes.

Work has been continued upon the harnessing of the waterfalls at Nore, on the river Laagen. The regulation of the Tunhovd lake has been completed, and tunnelling has commenced. Owing to a strike among constructional workers employed by the Government, work on the building of the railway from Kongsberg to the falls has made little progress, and it is now difficult to say when the railway will be completed.

Between 13 and 15 million kr. has now been expended upon the Nore scheme, and the future of the scheme depends largely upon the question whether it is decided to arrange for the transmission of power from Tyssefaldene to the east of Norway (see above). Work upon the Hakavik installation has been continued, but has been interrupted by the strike of constructional workers, which is still proceeding.

At Glomfjord, in the Nordland county, the State has now completed the installation of two machines of 25,000 h.p. each. An extra pipe line is under construction, which is to serve a reserve machine of 27,000 h.p.; it is probable that another machine of 27,000 h.p. will be installed later. The power from the two machines installed is delivered to a zinc smelting works. Inquiries for the delivery of power from the Glomfjord power station have been received from various sources, including American and British firms, but no contracts have yet been made.

The scheme for harnessing the waterfall on the river Laagen at Kongsberg has been postponed in view of an offer of 18,500 kW, which has been received from the Rjukan power station. If the offer from Rjukan is accepted, 4,000 kW will be delivered to the Buskerud county, 2,500 kW to the town of Drammen, and 12,000 kW to Christiania. The Norwegian Government would, in that event, complete the power line from Rjukan to Kongsberg, while the Buskerud county and the towns of Drammen and Christiania would construct the transmission lines for the remainder of the distance.

Work is being continued on the harnessing of Solbergfos on the river Glommen. The main dam and the power station are in process of construction, but it is possible that the scheme may be delayed if the Christiania municipality decides to accept the offer of power from Tysse. About 22 million kroner has already been expended upon the scheme, while orders have also been placed for machinery to the value of about 8 million kroner.

The electrification of the railway from Christiania to Drammen is now nearing completion, whilst that of the section of railway from Norway to the Swedish frontier (the Ofot Railway) has been resolved upon, and that of other sections is under consideration.

A Commission has been appointed by the Norwegian Government to consider the possibility of transmitting electrical power from Norway to Denmark. It would appear improbable that such transmission will become a practical proposition in the near future.

JOINT ELECTRICITY AUTHORITIES.

A Second West Riding (Aire and Calder) Scheme.

Consequent upon the provisional delimitation of the above-named area,* a conference of local authorities owning and operating generating stations within the district was held at Bradford in July, 1920, and was attended by representatives of 18 authorities, comprising the whole of such authorities excepting Heckmondwike U.D.C. The conference appointed a committee of eight members to prepare a scheme for improving the existing supply in, and the formation of a Joint Electricity Authority for, the district. The committee's report and scheme were duly approved by a further conference, held on February 24th, of representatives not only of local authorities owning and operating generating stations, but also of those in the district who are authorised distributors and purchase their supplies of electricity in bulk.

It will be remembered that an outline of another scheme having similar aims for the same district, but prepared by the Leeds Corporation, has already been published.†

The Committee's Report.

The first meeting of the committee, which consisted of the electrical engineers of the electricity supply undertakings at Batley, Bradford, Halifax, Huddersfield, Keighley, Leeds, Shipley, and Spenborough, with Mr. Thomas Roles as its chairman, first met in August, 1920; an abstract of its report follows:—

The Committee considers that any scheme which does not provide for the formation of a Joint Electricity Authority would only be in the nature of a palliative, and unless some authoritative body is formed having the duty of continually supervising matters relating to electricity supply in the district, efforts in the direction of improvement are likely to be spasmodic and carried out on individualistic rather than on co-ordinated lines. Any Joint Electricity Authority formed for the district should have full operative powers, as it is felt that an authority possessing merely advisory powers could only carry out its duties with the aid of a staff of inspectors, and that its recommendations would be often questioned, and friction and delay would result.

The only alternative to forming a Joint Electricity Authority would be for the Yorkshire Electric Power Co. to be appointed the Authority to control the generation and main transmission of electricity in the district. From an engineering point of view this should prove a most satisfactory arrangement, and the fact that under the Yorkshire Electric Power Act, 1901, that company has powers enabling it to become such an authority for the whole of the district, with the exception of a fringe on its northern and north-eastern boundaries, would greatly facilitate giving effect to such an arrangement. Moreover, the company has already in existence a considerable network of mains in the district which could be utilised to some extent for linking-up the various individual supply systems.

In the event of the Electricity (Supply) (No. 2) Bill‡ becoming law, under the provisions of Clause 12 of the Bill, a Joint Electricity Authority formed for the district could, providing a special Order to such effect were obtained, delegate its powers to the Yorkshire Electric Power Co., by which arrangement the Joint Electricity Authority would become an advisory body whose duty it should be to protect the interests of consumers in the district. This course would appear to be preferable to the company being appointed an authority directly. It is believed that the company would not be averse to entering into an arrangement on these lines with the local authorities in the district. The committee, however, realises that none of the above proposals, although sound from an engineering standpoint, will be acceptable to the majority of the local authorities in the district. The principle of the control of public utility undertakings by local authorities has obtained firm root in Yorkshire, and the total output of the Power Co., both to areas in the West Riding (Aire and Calder) and the North-East Midlands Electricity Districts, is exceeded by the output from the Leeds Corporation alone, and is not much (if any) greater than that from the Bradford Corporation.

With regard to main transmission, any Joint Electricity Authority which may be formed will be placed in a position of considerable difficulty so long as the Power Co. remains in existence and retains its present powers. Moreover, whereas the company has full rights of generation, main transmission, and supply in bulk throughout the greater part of the district, any Joint Electricity Authority which might be constituted would have its hands tied by the provisions of Section 12 of the Electricity (Supply) Act, 1919.

The Committee considers it possible that it may not be found advisable that the transfer of any but a few of the smaller generating stations should be effected, at any rate in the immediate future. Should such prove to be the case, the supplies which could be given by the Joint Electricity Authority would be so small that the heavy expenditure entailed in erecting a main transmission system could not be justified, unless the Joint Electricity Authority was prepared to build such a system for giving supplies to the Power Co. in certain parts of its area and so assist the company in continuing its development.

The Committee is, therefore, of opinion that if a Joint Electricity Authority is established, it is essential that the whole of the main transmission of electricity throughout the district should be placed in its hands. It is abundantly clear that if the Power Co. were given representation on the Joint Electricity Authority the voting power of its representatives would possibly in years to come have an equal if not a preponderating influence on the Joint Electricity Authority.

It must be clearly realised that the Power Co. is in possession of very different powers from those vested in companies working under the Electric Lighting Acts, and if a Joint Electricity Authority is formed its duties will be almost exactly similar to those of the Power Co., but, in addition, it may be granted distributing powers not possessed by the Power Co. If, therefore, the Joint Electricity Authority is to be a success, and no overlapping of rights and duties is to be permitted, it would appear that the only course which can be pursued would be for the Joint Electricity Authority to preferably consist of representatives of local authorities only, and that the Authority should take over the Power Co.'s undertaking, and with it the sole rights of main transmission in the district. Such portion of the Power Co.'s undertaking as is situated in the North-East Midlands Electricity District would in all probability be purchased by the Joint Electricity Authority to be set up for that district.

There are no Parliamentary powers in existence under which the Power Co. can be compelled to dispose of its undertaking to a Joint Electricity Authority, and the Government has decided that for the present the Bill under which powers were sought for the formation of District Boards, which could compulsorily acquire power companies' stations and main transmission lines, shall not be proceeded with. The Electricity (Supply) Act, 1919, however, does contain powers under which such an undertaking may be taken over by agreement.

The following is an extract from the reply of the engineer and manager of the Power Co. to the above proposal:—

"I am directed to say that in their (the directors of the company) opinion it is premature to ask the company to consider the sale of its undertaking to a body which does not exist and whose formation and constitution is not yet definitely decided. To reduce the company's area of supply would be, in the views of my board, a direct contravention of the vital principle of which the Power Act was an expression. The company is prepared to consider and to take part in any developments which will, in its opinion, be to the interests of the community in the area as a whole, but for the reasons above mentioned it is not prepared at present to discuss with you the sale of a portion of its undertaking."

The Scheme.

The draft scheme, which has already been definitely adopted by a number of Town Councils, proposes, *inter alia*, that the Joint Electricity Authority shall consist of 40 members representative of all local authorities (*a*) being authorised distributors within the district, (*b*) having the right to purchase the whole or any part of any undertaking of authorised distributors within the district, and (*c*) the county council as representing the local authorities of all areas in which electricity is (i) supplied otherwise than under a Provisional Order, and (ii) not at present supplied.

The basis of representation shall be: Local authorities who are acting as authorised distributors and the populations of whose areas of supply do not exceed (1) 25,000, to be grouped and given one representative for every 25,000 inhabitants; (2) from 25,000 to 50,000, one representative each; (3) from 50,000 to 100,000, two representatives each; (4) over 100,000, three representatives each, plus an additional one for every complete 100,000 in excess of the first 100,000; (5) local authorities (other than county councils) in whose areas electricity is supplied by other authorities or companies under provisional orders, to be grouped and represented according to item (4) on the aggregate of the populations of their areas; (6) county council, one representative for every complete 150,000 of the total population in the areas of urban and rural districts for which the councils of such districts are not entitled to appoint or take part in electing members other than those under item (6).

The rest of the provisions in connection with the administration of the scheme are generally similar to those of other schemes, outlines of which have already been published. It is proposed that the purchase powers of local authorities in the district shall, at the expiration of 12 months from the date of the establishment of the Joint Electricity Authority (unless otherwise arranged) be transferred to and vested in the Joint Electricity Authority, subject to a right of appeal to the Commissioners.

The undertaking of the Yorkshire Electric Power Co., and all its rights and interests therein, shall as from such date prior to December 31st, 1922, as shall be specified in the order constituting the Joint Electricity Authority vest in the Electricity Authority absolutely (the intent being that so much of the said undertaking as is not situate within the district shall be transferred to and vested in the Joint Electricity Authority for the North-East Midlands Electricity District (if and when established) on such terms as shall be agreed or, failing agreement, as may be determined by arbitration.

Regarding the technical provisions of the scheme, the supply will be on the three-phase, 50-cycle, a.c. system. The main transmission pressure will be 33,000, and the local secondary

* Elec. Rev., p. 815, June 25th, 1920.
† Elec. Rev., p. 95, January 21st, 1921.
‡ Elec. Rev., p. 844, Dec. 31st, 1920, and p. 196, Feb. 18th, 1921.

transmission pressures 11,000 and 6,600 volts according to the voltage at present in use at the distributing centre concerned, but for reasons of economy 11,000 volts will be adopted wherever possible at distributing centres in which the pressure is at present 6,600 volts. The generating stations at Bradford, Halifax, Huddersfield, Leeds, Thornhill, and Wakefield will ultimately become the distributing centres for the areas surrounding them, and will be linked together by main transmission cables. Extensions from these centres will be made by 33,000-volt cables to sub-distributing centres, at such times as may become necessary.

The main transmission lines will consist of 3-core, 0.15, 0.2, and 0.25 sq. in. cable, 11.25 miles of which will be at 11,000 and 80.5 miles at 33,000 volts, and it is proposed to complete 38.75 miles by August, 1922; 10 miles by August, 1923; 22.75 miles by August, 1924; 7.75 miles by August, 1925; and 12.5 miles by August, 1926.

It is proposed that throughout the period covered by the scheme, and possibly for some time afterwards, the existing generating stations at Bradford, Halifax, Huddersfield (St. Andrew's Road—general supply), Leeds (Whitehall Road—general supply), Thornhill, and Barugh, so far as the generating plant which is operated by means of waste heat is concerned, shall be utilised in conjunction with the new capital stations. The proposed extensions of plant (including extensions already authorised) at the existing generating stations above named, and the ultimate capacity of such generating stations on the completion of the proposed extensions are as follows:—

Station	Proposed extensions. (Max. cont. rating.)	Ultimate capacity of stations. (Max. cont. rating.)
		kW.
Bradford	Two 15,000-kW turbo-alternators	50,000
Halifax	Two 10,000-kW turbo-alternators	29,500
Huddersfield	One 10,000-kW turbo-alternator	24,000
Leeds	Two 12,000-kW turbo-alternators	75,000
Thornhill	Three 12,500-kW turbo-alternators	49,500
Barugh (waste heat)	Nil	1,500
	Totals ... 10 sets	229,500

Until the capital stations are erected and operating to their full capacity it will be necessary to utilise the remaining generating stations, with a few exceptions, and possibly to extend the plant in some of them; as these stations become linked up with the existing stations their running hours will be reduced, and finally they will be discarded. It is proposed that the erection of two capital stations shall be immediately commenced, one in the vicinity of the existing station belonging to the Wakefield Corporation, on the river Calder, and the other in the vicinity of Apperley Bridge, on the river Aire, and that three turbo-alternators each having a maximum continuous rating of 20,000 kW shall be in commission in the Wakefield capital station, and two turbo-alternators each of the same rating shall be in commission in the Esholt capital station, by August, 1924. The ultimate plant capacity of each of the capital stations will be 100,000 kW.

It is proposed that the Minister of Transport shall immediately commence the construction of the two capital stations, and shall from time to time commence the construction of the main transmission lines mentioned above in order that such stations and lines may be respectively in commission by the dates mentioned, it being the intent that the Electricity Authority shall become responsible for financing the works, whether commenced by the Minister of Transport or otherwise, as early as possible after the establishment of the Electricity Authority.

The Electricity Authority is to repay to the Minister of Transport within a period of five years from the date of the order constituting the Electricity Authority the sum expended by him up to the date when the Electricity Authority becomes responsible for financing the works of construction as aforesaid, together with interest thereon to enable him to repay the Treasury.

There are 25 existing generating stations in the district, of which four are used mainly (if not solely) for tramway supply, namely: Huddersfield (Longroyd Bridge); Leeds (Crown Point); Yorkshire (West Riding) Electric Tramways Co., Ltd. (Belle Isle, Wakefield, and Castleford). It is intended that these stations shall remain in the hands of the present owners, but provision has been made for providing bulk supplies to such owners on their stations being shut down. On a scheme of any magnitude for the electrification of the railways in the district being decided upon it will become necessary to consider the advisability of erecting a further capital generating station and the provision of additional main transmission lines.

Finally, the financial details of the scheme are set out, which are generally similar to those relating to other schemes that have already been outlined.

The Yorkshire Electric Power Co.'s representation referring to the above scheme, and the L.C.C.'s scheme for the London and Home Counties District, will be outlined in our next issue.

The Chester and North Wales Inquiry.

Summary. (*Concluded from p. 234.*)

On Monday, February 21st, it was admitted that the Power Co. had written up its assets in the year 1918-19, from £331,459, to £532,882, on the ground that they had appreciated in value; the debenture interest was then eleven years in arrear. A considerable amount—£111,800—stood in the balance sheet in respect of railways, of which only a short length had been constructed, and this was worked by one horse which, when in good condition, made one journey each way daily. The one-horse railway caused considerable amusement, and was *the* joke of the Inquiry.

An important feature in the complicated financial arrangements is that the Aluminium Corporation owns the principal water power (at Dolgarrog), and is to give a bulk supply as required to the North Wales Power Co. to the extent of 11,000 kW on demand, but the Power Co. is to pay ¼d. per unit on a 45 per cent. load factor, and invest £250,000 in the corporation, as second debentures. The load factor of the company at present is about 25 per cent., and it is quoting the Rhyl Council 1¼d. per unit on a present load factor of somewhere about 12½ per cent. and a consumption of 350,000 units per annum. One can only say that Mr. Jack, of the North Wales Power Co., has shown great confidence in the future generosity of Mr. Jack of the Aluminium Corporation, when, as seems inevitable, the former approaches the latter to ease his burden.

The proposed advisory committee was shown to give one representative to Holyhead, with an area of 731 acres, a population of 10,636, and a rateable value of £25,031, and also one only to the Crewe and Nantwich areas, with an acreage of 122,760, a population of 82,413, and a rateable value of £485,907. There are to be 26 area representatives, two for large consumers, and four or five for railways, and, of course, the company need not take any advice given by the committee.

Another interesting point was the allowance of ¼ per cent. for depreciation, which is little enough to make a corporation engineer's mouth water. Of course, a large portion of the expenditure is on civil engineering work, but an equally large proportion is on overhead trunk mains. Sir Philip Dawson supported this figure on the Tuesday, so that, perhaps, the evidence of such an authority given to the Commissioners will ease the way of proposed joint board engineers who depart from the time-encrusted L.G.B. schedule in their estimates.

A most astonishing and gratifying state of things was divulged when a financial expert, Mr. Wells, stated that it would be possible for a company in the position of the North Wales Power Co., now paying 10 per cent. interest on second debentures, to raise all its new capital by means of bonds on a basis of 8 to 8½ per cent. interest, without any further ordinary or preference share subscription. Sir Harry Haward appeared to doubt it; in fact, that part of him which was evolved from L.C.C. methods was distinctly shocked. Sir Philip Dawson generally confirmed the view of Mr. Wells, basing his opinion on cases he knew of where large sums were being raised abroad by bond issues, with no cash subscription on ordinary shares. Indeed, it appears that a company is to be judged no longer on its past, but upon its hopes for the future. This, if it happens, is sure to be a great help to other schemes, and with regard to Joint Authorities, one is consoled by the reflection: If a company can do this, how much more, then (to use the language of the ancients), can a Joint Authority, with a rate backing and no "past," raise money at a lower rate of interest for the greater benefit of the community!

There was, throughout the Monday, considerable confusion as to the Parliamentary position with regard to the scheme. The company proposes to take the rights and obligations of a Joint Authority under the 1919 Act (if a company can do such a thing—and even its counsel was doubtful), yet it proposes a new Act of Parliament embodying its draft proposals. It is obvious that the company's proposals are quite different from those of a Joint Authority, and it did not seem to be appreciated—even by the Commissioners—that this new Act would take precedence of the 1919 Act on any points of difference, rendering the statement as to rights and obligations of no effect. It was clearly realised, however, that owing to bad drafting of the proposals, a very pretty tangle resulted. This bad drafting was throughout the Inquiry excused by calling it a "business scheme" and not a legal document. As a result, the Inquiry eventually closed without anyone knowing what the scheme really would be, even on its most important points, if the Commissioners approved it.

The seventh day of the Inquiry, Tuesday, February 22nd, produced much expert evidence dealing with the water power, and as previously stated, one cannot but be impressed by the company's scheme. The experts engaged have thoroughly dealt with the wonderful natural facilities. Mr. Vincent, acting for the Quarry Owners, led Mr. Jack to admit that he was a member of the Carnarvon County Council, and had actually drafted the resolution of that body in favour of his company's scheme! Mr. Vincent made an appeal for preferential reservation of Welsh water powers for Wales, and was very neatly answered by Mr. Jack to the effect that the local interest in it was belated. They had left the power unused down the centuries, and nothing adequate had been

done, nor could be done until a market was provided outside the Principality—there being almost none within it.

Mr. Fennell, for the Northwich Electric Supply Co., pointed out the possible bad effect of the ¾d. bulk rate as between the Aluminium Corporation and the Power Co. in hampering the latter in quoting its distributors for high load factor business, such as pumping, and this eventually led to an assurance that a special price would be arranged—between Mr. Jack and Mr. Jack—in such cases to secure the business. The confusion referred to above between the Power Co.'s proposals and the 1919 Act as to its dealings in the areas of authorised distributors then became acute. It was also brought out that on an average revenue of 1½d. per unit the company could, under its Act, pay 20 per cent. dividend, plus a very large sum to make dividends equal that amount from the commencement. Mr. Fennell's last question, viz.: "Has not the time arrived to shorten the inquiry by offering to supply a Joint Authority in bulk?" was probably an expression of the general feeling of those present.

The Commissioners, through Sir Harry Haward, were very inquisitive as to the finances of the company, through Mr. Booth as to the proposed Parliamentary procedure, and through Sir John Snell as to the advisory committee. Grave doubts were expressed as to the prospects of such a Bill as that suggested. Sir John Snell foreshadowed a possible solution of the difficulty on the lines of a Joint Authority formed to exercise political control—delegating these powers to a small committee to be represented on the company's board. Sir Philip Dawson then followed, and he shortly blessed the technical scheme, but his evidence was clearly sought on financial grounds, as already indicated. He gave very interesting "life" figures for the different classes of works, and these should be kept for future use by engineers in general. Mr. Page, for the Commissioners, obtained a useful opinion that "the fewer protective devices there are, the greater the safety" in the sense that substantial works were better than an excess of automatic cut-out devices.

Mr. Freeman, of Sir Douglas Fox & Partners, gave most interesting information as to the methods of obtaining storage, the rainfall, and civil engineering details in general, but they cannot be summarised. Mr. Paton, the company's electrical engineer, gave details as to the arrangement of the electrical plant—load factors, &c. The present load factor on the system is 25 per cent. on a 7-day, and 40 per cent. on a 5-day basis, and 60 per cent. during "quarry working hours." They hoped to obtain 45 per cent. by adding the eastern industrial area, but did not state whether on a five or seven day basis. The transmission losses were allowed at 10 per cent., notwithstanding the great distances contemplated. There were many further questions on the estimates of working costs, but nothing useful was added, though a great deal of time was absorbed before the case closed.

The remarkable speech by Mr. Tyldesley Jones, for the railway companies, introduced a very doubtful point. He represented one-ninth of the rateable value of the area—much of it, no doubt, at Crewe and Holyhead and along the London and North-Western lines—but it must be remembered that his rateable value was already represented heavily by each local authority; and in the absence of any promise to become a very large consumer, it was clearly a case of double representation. He plumped for the North Wales Co.'s scheme, on both technical and administrative grounds, he objected to any risking of the rates—he objects to rates, just as most other people object to railway rates, as being alarmingly high—he disliked public control of an electricity undertaking, but was careful to state that this did not necessarily mean opposition to other municipal activities. He, in fact, said all that a railway company's representative would be expected to say on the subject—but he said it very cleverly, and made a profound impression, such as can only be made by a K.C. of the first rank. On reflection, it may be said that a strong railway company needs no protection against a comparatively weak power company, and *might* even secure better terms from a company than from a Joint Authority representing consumers in general; but still that reflection may not occur to some who heard the speech. Mr. Jones was careful to state that he expressed no opinion on the company's financial proposals—he left that responsibility to the Commissioners! Supposing the Commissioners follow Mr. Jones and approve of the scheme, but find they must reject the financial part of it, what remains but the formation of a Joint Authority?

The rest of the sitting was occupied in special business, dealing with the case of Mrs. Owen, who, her representative, Mr. Kellow, stated, had commenced to construct a reservoir for a hydro-electric scheme of 1,200 kW near Barmouth, to supply that town and others, and had spent a considerable sum of money, before discovering that the North Wales Power Co. included this district in its Act. Mrs. Owen had been referred to this Inquiry by one whom Sir John Snell termed "a possibly over-cautious official" of the Commissioners. Sir John could only refer Mrs. Owen back to the officials. We did hope the Commissioners would be the one Government body which would be free from what Charles Dickens described as "circumlocution"! However, Mrs. Owen has an assurance that her case will be considered, and that promptly.

The business on Wednesday morning consisted of a statement made by Mr. Morris, counsel representing Carnarvonshire, and by the principals representing the two schemes (Mr. Miller, K.C., for the company, and Mr. Dickson for the Chester Corporation). Each set out the advantages of his clients' scheme, and the glaring defects of that of their opponents. The one scored as heavily on technical grounds as did the other on those of finance and organisation.

And so the Inquiry ended, the first which has been pushed to completion, having lasted eight days. The unfailing courtesy of the Commissioners, their expert knowledge of all branches of the subject, the tactful manner in which Sir John Snell intervened to bring out important information or to prevent irrelevant matter being introduced, leaving no sting behind, were acknowledged by all. It is with no little pride that we can record the success of the Electricity Commissioners as a tribunal during the hearing of evidence.

And now for the result. The wisdom of a Solomon, in fact of Solomons to the *n*th power, will be possessed by the Commissioners if they can straighten out the tangle and devise an acceptable compromise!

The transcript of the shorthand notes, wonderfully supplied by Messrs. Lee & Nightingale, of Liverpool, each morning, covered the previous day's proceedings, and was marvellously accurate. These notes total about 650 foolscap pages, and if supplied with an index, will be most useful and interesting reading. It is to be hoped that a copy will be supplied to the Institution of Electrical Engineers' Library.

(*Concluded from p. 270.*)

Monday, February 21st, was wholly taken up with the cross-examination of Mr. Jack.

Mr. J. H. Dickson questioned Mr. Jack at some length as to the heads of the agreement which it was proposed should be entered into between the North Wales Power Co. and the Aluminium Corporation for the regulation of the supply of power by the latter to the former company.

Mr. Miller, K.C., for the Power Co., handed in a copy of the heads of the agreement. It was intended that the agreement should continue as long as the Power Co. was the authorised undertaker for the district, and that the Aluminium Corporation should up to the limit of its 10,000 kW capacity supply energy to the Power Co. at ¾d. per unit, provided the load factor was not less than 45 per cent. This, Mr. Jack said, was the load factor which was anticipated. The price stated was subject to a clause as to wages, but that was in conformity with the agreements the Power Co. had with its customers.

Mr. Jack said the promoters would be quite prepared to seek the advice of the Commissioners as to what the load factor should be in fairness between the two companies. The intention of the agreement was to place at the disposal of the Power Co. the whole of the energy that could be generated at Dolgarrog, and when the customers of the Power Co. required it, the manufacture of aluminium at the Dolgarrog works would be suspended. The agreement would not be made if the district was not extended.

Answering Sir J. Snell, Mr. Jack said he would be prepared to give such reasonable and proper guarantees to maintain the position as between the two companies as the Commissioners might think fit to impose.

A series of questions followed relating to the capital and liabilities of the two companies. To one question as to what proportion of the total capital shown on the balance sheet of the Corporation represented water rights, and what proportion represented the works carried out, Mr. Jack objected on the ground that it was an attack upon the Aluminium Corporation. After consideration the Commissioners upheld Mr. Jack in his objection.

Mr. Jack said he was prepared to produce to the Commissioners anything and everything connected with his private figures, as well as the figures which he was willing to give to Mr. Dickson.

One of the items grouped together among the assets of the Power Co. was stated to be "railways." Mr. Dickson asked what railways the company had. Mr. Jack said the Croesor railway was completed and in operation.

Mr. Dickson: What kind of traction is being used?

Mr. Jack: One horse. It goes up and down once a day if the horse does not get lame. When the water in the two lakes was obtained, long before his time, it was proposed that the company should use some of the water to run the railway by electricity.

Interrogating Mr. Jack with reference to the financial clauses of the scheme, Mr. Dickson pointed to a clause in the Power Co.'s scheme which would give the company authority to assess upon the present users of energy supplied upon pre-war contracts a *pro rata* increase, equal to the increased cost of production, such increase to be decided, failing agreement, by the Commissioners.

Mr. Tyldesley Jones, for the railway companies, suggested that this was a new power in excess of anything contained in the Courts (Emergency Powers) Acts.

Mr. Jack said the Power Co. had been fairly met by its consumers, and the clause referred to could be omitted from the scheme.

As to the proposed "advisory committee," the witness was cross-examined on the basis of representation. He would give one representative, he said, to each distribution area, irrespective of its population and rateable value. Its resolutions, he thought, would in nine cases out of ten be acted upon by the company, and in the exceptional case the com-

mittee would go to the Commissioners. Whether the Power Co. acted on the advice or not depended upon the goodwill existing between the company and the committee. It would sit between the Commissioners and the company, and would give advice no doubt to both. He did not think a Joint Electricity Authority was needed for the district. The advisory committee would have no power as to prices charged to consumers, or as to the profit to be distributed to the shareholders of the company.

It was intended that local authorities and other consumers taking electricity should advance capital to the Power Co. for the construction of extensions of the transmission lines required for the delivery of that electricity, and the security for the capital advanced would be the poles and wires so erected. The form of security would be a mortgage upon those poles and wires, which would not, of course, be of much value for their purpose if the power at the other end ceased to flow into them, but he did not agree that they formed no security for the lender.

With regard to the question of rates and taxes, the chairman said the Commissioners were not satisfied with the allowance for these costs in either scheme.

Mr. Jack stated that depreciation was adequately provided for in the 10 per cent. added to the estimates for contingencies. The power transmission lines had to be maintained in good condition out of revenue.

Mr. Tyldesley Jones, K.C., for the railway companies, submitted that the clause in the scheme providing for the assessment of any deficiency in revenue in any year upon users of energy was illegal, impracticable, and uncommercial.

Mr. Jack said he would gladly drop the clause if he could, but for the moment could not see his way. He admitted that Holyhead was likely to be a large consumer owing to the extensive railway and harbour works there, but he preferred in the first instance to cater for the eastern industrial area, and the scheme did not provide for extension of the transmission line to Holyhead until four years hence. The railway company, if they wished, could construct a line at once, and the Power Co. would pay interest on the outlay.

Mr. Arthur Wells, managing director of the City General Trust Co., gave evidence on the Power Co.'s proposals for financing their further constructive works, which generally he approved. Cross-examined by Mr. Tyldesley Jones, witness said he did not attach much importance to the suggested deficiency clause.

Sir Harry Haward pointed out that, as proposed, the ordinary share capital of the Power Co. would be no more than 9 per cent. of the total capital of the undertaking. This was a very low proportion. Parliament, as a special concession in the Public Utility (Capital Issues) Act last year, allowed capital to be increased by borrowing not exceeding 50 per cent. of the share capital.

Mr. Wells thought that under the existing conditions it would be impossible to finance the enterprise otherwise than by bonds at a fixed interest.

On Tuesday, February 22nd, Mr. Miller announced that the Power Co. had decided to withdraw the deficiency clause in the scheme. Referring to the clauses in the Electricity Act as to certain duties which should be imposed upon a Joint Electricity Authority, he said the Power Co. was prepared to take over such duties, and if necessary to obtain powers in the proposed amending Bill.

The Chairman said the object of the Commissioners would be to endeavour to get the local authorities and the company to work together harmoniously, whatever the decision on the scheme might be.

Mr. H. C. Vincent then resumed his cross-examination of Mr. Jack, who said that Mr. Kenneth Clark, who had taken up the shares in the Power Co., was the managing director of Messrs. J. & P. Coats, Ltd. It was proposed to give him second debentures in the Aluminium Corporation in respect of the amount advanced. Mr. Clark put the money up to enable the Cowlyd dam to be completed, which made the scheme possible, and it was reasonable that the money should be returned to him. The interest paid to Mr. Clark was 10 per cent.

Mr. Vincent: Should not Wales have the first call on her own resources? and would it not be better for a clause to that effect to be put into the scheme?

Mr. Jack: If you continue that parochial attitude you will never have those powers developed.

In answer to Mr. H. J. Owen (Merioneth C.C.), Mr. Jack said he had an offer of the water power in their district, and if he did not buy it objection would be raised to his scheme.

Mr. Hugh Parry (Conway Corporation) said his was a small local authority; it was hoping to get a bulk supply through this scheme. Small local authorities were concerned as to the price they would be charged for a bulk supply at their boundary. What was the minimum quantity to come in at the low rate?

Mr. Jack: No rules have been established, but the price will be 1½d. to 2d. per unit according to the demand. The price in no place would be more than 2d.

Mr. Parry said the higher price would have a tendency to discourage small local authorities from committing themselves to take the supply in their areas.

Mr. Jack was examined by the Commissioners as to the financial aspect of his scheme, and said he did not expect any financial assistance from county councils, although a proviso had been put in to that effect, owing to an agreement having been come to with the Colwyn Bay Council, which was prepared to advance the money (provided it could get the necessary sanction) in order to get the transmission line sooner than he would be able to provide it, and he was prepared for other authorities to do the same. The development of water power meant the locking up of a large amount of capital, and the development must be left to private enterprise as public authorities could not bear the expense to do it on a large and comprehensive scale. The effect of drought depended entirely on the storage capacity, and all consideration was given to that point before the scheme was brought forward. He agreed that public control was desirable, but not to interfere with the work of generating the power.

The Chairman: The Commissioners have not come to any conclusion on the matter, but if some machinery were devised which would set up a form of public control after consultation with all the parties interested, would you be prepared to go into it heart and soul?

Mr. Jack: Yes.

The Chairman: It will be necessary for you to go to Parliament for another Bill?

Mr. Jack: I am afraid so, and no doubt there would be opposition to it.

The Chairman: If the report of the Commissioners is in your favour, we may rely on your cordial co-operation to devise the best possible method for your district?

Mr. Jack: Certainly, I am not wedded to any method.

The Chairman then thanked Mr. Jack for the work he had done with regard to the scheme, and noted his desire to co-operate with the local bodies, which was greatly appreciated.

The Chairman, on the previous evening, had stated that it would save the time of the Commissioners if counsel representing local bodies which intended to make any general observations would hand them in, and at this stage several handed in written statements.

Sir Philip Dawson, M.Inst.C.E., a member of the firm of Kincaid, Waller, Manville & Dawson, was called, and said he considered the figures given as to the revenue and expenditure of the Power Co. were reasonable, and there should be no difficulty in securing the capital. He did not think it necessary to provide a sinking fund for the dams, as there were in existence dams that went back to the Roman days. The average life of transmission lines was 40 years, and a half of 1 per cent. was an ample provision for their renewal. With regard to raising the capital by bonds, this was a common procedure in other countries; his firm was engaged on a large undertaking in South Europe amounting to £10,000,000 for the erection of a hydro-electric station, and the money was being raised by bonds with the exception of a small percentage of capital which did not represent any cash. With regard to safeguards, he had recently been visiting a line in Germany 80 miles long, which ran through Berlin with bare wires, and it had been operating since 1915 without a breakdown.

Mr. Ralph Freeman, a partner in the firm of Sir Douglas Fox & Partners, was then called, and said he had been engaged on the work at Dolgarrog and Cwm Dyli for the past six years, and the proposed scheme was based on reports from his firm. He gave details of the annual rainfall on Dolgarrog catchment area which averaged 84 inches; the rainfall on some days averaged five inches. At Cwm Dyli the rainfall averaged 80 per cent. higher. The witness then, by a diagram, explained to the Commissioners the Cowlyd rainfall and storage for the past 13 years.

Mr. G. K. Paton, M.I.E.E., chief electrical engineer of the North Wales Power Co. and the Aluminium Corporation, was the next witness, and stated that a new installation which would be running in a week or so, of 1,500 kW, had cost £9 17s. 10d. per kW on actual prices paid to-day, so the price set down for new plant at £10 was a reasonable sum. At Maentwrog the cost had been set down at £8 per kW, but they were proposing to put in bigger sets.

Cross-examined by Mr. Tyldesley Jones, the witness said he agreed that the cost of production was cheaper at Dolgarrog that at Maentwrog.

Mr. Tyldesley Jones: Then why not use all your available surplus from Dolgarrog?

Mr. Paton: We will if there is any.

The Chairman: That is an important point.

After legal argument between Mr. Miller and Mr. Jones on the figures given, Mr. Miller said that they would see that the surplus from Dolgarrog would be fully utilised.

The Chairman: We shall be obliged to ask for more details as to figures supplied for the erection of transmission lines, such as wages, rating, and upkeep; these are very material.

Mr. Miller said that was his case.

Mr. Tyldesley Jones, speaking for the Railway Companies (but not for the Cambrian Railway), corrected an error he had made at the outset; the rateable value of the railways in the area was half a million, and not a million as stated. The railways on the North Wales coast had very heavy traffic in the summer time, carrying people from the Midlands to the seaside, and they were interested in any scheme of electrification which it was possible to carry out. The railways could not give their adherence to the Chester scheme; he contended that the estimates of the scheme had been shaken, and he was of opinion that public money ought not to be expended on it. Regarding the North Wales Power Co., the position

needed careful scrutiny by the Commissioners, and he hoped that the consumers would be protected in every way possible by means of an Advisory Committee or public control. It had been suggested that the principle of the Act of 1919 was public control, but he questioned that. He asked the Commissioners not to bring in any public money to the North Wales scheme. Public control meant the dragging in of public money, and he asked them not to allow the Power Co. to be in a position to reimburse deficits by public money. Their objection to the Chester scheme was not against municipal enterprise. They supported the North Wales Power scheme because they thought they would be benefited by the cheap supply they would be able to get at certain points. He was not prepared to express any opinion on the financial part of the scheme.

Mr. M. Kellow appeared on behalf of Mrs. M. A. Owen, Aber Artro Hydro Electric Lighting and Power Works, Llanbedr, Merioneth, and asked for the area Barmouth to Harlech, on which money had already been expended, to be excluded from the North Wales Power Co.'s district, and a special Order to be granted to Mrs. Owen. Resolutions were put in from the Barmouth U.D.C., Harlech, and two other authorities in support of the scheme.

The Chairman said Mr. Kellow had better make an application for a special Order to the Commissioners; whether he would get it was another matter.

The proceedings were brought to a close on Wednesday noon.

At the commencement of the day's proceedings Mr. T. E. Morris, on behalf of the Carnarvonshire C.C., said he was instructed to support the North Wales Power Co. and oppose the Chester scheme because of the burden that would be placed upon the rates, which were already high enough. The joint authority proposed by Chester would be unwieldy, and the control would practically fall into the hands of a few officials. He called the attention of the Commissioners to the statement in the report of the Electric Power Supply Committee to the effect that in every case the authority should be as small in size as possible. The management of the Power Co. was in the hands of a small body of experts. The County Council had passed a resolution in favour of the setting-up of an Advisory Committee, which might consist of the chairmen of the electricity distributing authorities. If a joint authority were set up, the eastern zone, owing to its greater population and rateable value, would inevitably swamp the western zone. Having regard to the fact that the Power Co. was now supplying electricity, whereas at Chester nothing had been done, he thought the Power Co.'s scheme should be adopted.

Written statements were handed in by various representatives.

Mr. Miller submitted that after hearing the evidence on both schemes, the Commissioners could only come to one conclusion—that the Chester scheme was dead. It had been proved that the figures were all wrong, and the cost of production had been greatly understated. He then dealt with the criticisms levelled at the North Wales Power Co.'s scheme from a financial point of view, which he contended was the only real criticism that had been offered.

Sir Harry Haward: I agree that the financial position has greatly improved, but what did Mr. Jack mean in his evidence by "assured revenue"?

Mr. Miller: By that he means that if the company gets an assured market for the energy it can supply, it has the water power, it can develop it, and it can give the energy in ample quantities.

Mr. Miller, continuing his statement, said the company had promises of large contracts; an agreement had been reached with Colwyn Bay, and negotiations were proceeding with Llandudno. Not one penny was needed for the scheme from public bodies; there would be no call on the rates, and there was no possible liability on the areas. Mr. Tyldesley Jones came to the inquiry as an opponent, and as a result of the inquiry he stated that as a potential consumer the railway companies would support the scheme. Mr. Vincent, the company's largest customer, had also gone away satisfied, and most of the public authorities were in favour of the scheme.

Mr. Taylor pointed out that Mr. Tyldesley Jones did not state that he was in favour of the Power Co.'s scheme from a financial point of view, but from an engineering point of view.

Proceeding, Mr. Miller said the company was prepared to give a cheap supply of energy without a penny of public money being utilised, but if the public had a right of control, then the company would have a right to demand public financial support.

Sir Harry Haward: But if a company is given a monopoly, some equivalent to public control should be given, if no assistance is given out of public funds?

Mr. Miller: The company is prepared to meet it at its own expense. Mr. Jack appreciated that the scheme was for a public service, and was prepared to accept a form of public supervision.

The Chairman: Some clause should be inserted so that in the event of the company being unable to carry out its obligations, public authorities could carry out the work.

The Town Clerk of Chester, in his reply with regard to the Chester scheme, contended that the cross-examination of Mr. Britton had not shaken the latter's evidence in any material respect, on the financial side of the scheme. The Commissioners had ample powers to secure the land on the banks of the Dee for the erection of the proposed low-fall power stations. He then went on to criticise the Power Co.'s financial position, and said that if it were granted an Order and proceeded to Parliament for a Bill, the severest opposition would be set up by public authorities, and the scheme would be delayed for two years.

After Mr. Miller had briefly replied to the points made, the inquiry closed.

Mersey and West Lancashire Inquiry.

Objections to the scheme for a Joint Electricity Authority for the Mersey and West Lancashire District were considered on Tuesday last, when the Electricity Commissioners resumed their inquiry at the Liverpool Town Hall. The earlier proceedings were reported in our issues of February 4th and 11th.

At the outset, Mr. Honoratus Lloyd, K.C., who appeared for the authorities supporting the scheme, intimated that he had received a letter from the Town Clerk of Warrington enclosing a resolution to the effect that the time was inopportune for schemes involving great capital expenditure, and requesting the Commissioners not to proceed with the constitution of the Joint Authority. A resolution of the St. Helens Town Council was also read, stating that having regard to the evidence given by the Liverpool electrical engineer and the attitude adopted by Birkenhead, Wallasey, Bootle, Warrington and Southport it could not give further support to the present scheme. It considered the preparation of a scheme for another area advisable.

The Chairman asked the representatives of the two Councils to give an explanation of the reasons for the withdrawal, but both considered the time inopportune, and promised a statement later.

At the conclusion of the day's proceedings the Commissioners asked the representatives of Warrington and St. Helens to meet them in their private room. The counsel for the schemes which were under consideration were also invited to meet the Commissioners.

The proceedings were mainly occupied by the opposition of the Mersey Power Co. to inclusion in the Joint Authority. Mr. G. W. Malcolm, managing director of the company, gave an account of the utility of the company's electricity services, and although very guarded in his replies and obviously reluctant to disclose certain information, promised to convey certain particulars to the Commissioners privately. He declared himself very emphatically against the Joint Authority, describing it as communal control.

Mr. James Nelson, the company's electrical engineer, then gave evidence, and was about to be cross-examined—and Mr. Honoratus Lloyd, K.C., said he had a lot of questions to ask witness—when the inquiry was adjourned until 10 a.m. on Wednesday morning.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Annual Dinner.

On Thursday, March 3rd, the annual dinner and reunion of the Institution was held at the Hotel Cecil; the attendance created a new record, there being 440 present, compared with 380 last year—which was also a record number. Mr. Ll. B. Atkinson, the president, occupied the chair, and the guests included Profs. C. S. Sherrington, F.R.S. (president, Royal Society), and Sir W. H. Bragg, K.B.E., F.R.S. (president, Physical Society), Sir John Bland-Sutton, F.R.C.S. (president, Royal Society of Medicine), Sir W. J. Pope, K.B.E., F.R.S. (president, Society of Chemical Industry), Mr. A. W. Berresford (president, American Institute of Electrical Engineers), Lieut.-Col. Sir F. Younghusband, K.C.S.I. (president, Royal Geographical Society), Sir John Snell, Sir Harry Haward, Mr. W. W. Lackie, C.B.E., Mr. A. Page, and Mr. H. Booth, O.B.E. (Electricity Commissioners), Prof. Sir J. E. Petavel, K.B.E., F.R.S. (director, National Physical Laboratory), Mr. W. O. Smith (chairman, B.E.A.M.A.), Sir Frank Heath, K.C.B. (secretary, Department of Scientific and Industrial Research), Sir W. Noble (engineer-in-chief, G.P.O.), Capt. H. R. Sankey, C.B., C.B.E. (president, Institution of Mechanical Engineers), Major H. Richardson, O.B.E., M.C. (president, I.M.E.A.), Dr. R. Knox (president, Röntgen Society), Dr. S. G. Scott (president, Electro-therapeutic Section of the Royal Society of Medicine), Prof. A. W. Porter (president, Faraday Society), Mr. E. C. Wansbrough (chairman, C.M.A.), Mr. Hugo Hirst (president, E.D.A.), and many other distinguished men, whilst past and present members of Council, including Col. R. E. Crompton, Dr. S. Z. de Ferranti, Mr. C. H. Wordingham, C.B.E., Mr. A. A. Campbell Swinton, F.R.S., Dr. W. H. Eccles, Sir James Devonshire, K.B.E., Mr. J. S. Highfield, Mr. R. T. Smith, and Mr. C. P. Sparks. Mr. A. Carpmael (hon. solicitor), and Mr. P. F. Rowell (secretary) were present.

After the loyal toasts, the president read telegrams of

greeting from the Italian Electrotechnical Society and the American Institute of Electrical Engineers, and dispatched replies. Prof. Sir W. H. Bragg then proposed "The Institution of Electrical Engineers," expressing the pleasure that any physicist must feel in wishing success to an institution whose aims were so closely akin to his own. In the early days the physicists had shared in the development of electrical science, and now again they were in close co-operation with electrical engineers in dealing with atomic and electronic magnitudes. The Institution embodied very high ideals—it taught everyone who belonged to it to be an efficient servant of his country, and that success depended not on what one received, but on what one had to give. An institution like an individual must seek to render service; the Institution had fulfilled that great ideal; moreover, it had found a great president, a man in whom they were all honoured.

In his reply, the President pointed out that Sir William Bragg was no stranger to the Institution; his recent Kelvin lecture on the electron and the atom was one of the most profound yet simple addresses they had ever been privileged to hear. The roll of the Institution now numbered over 9,400; besides the public work in which it was engaged, there were 14 committees meeting frequently and carrying on departmental work; the Institution was also represented on 40 external bodies, and in January and February 47 meetings and discussions were held in London and the Provinces. All this voluntary and co-operative activity must have its effect on the scientific and industrial work with which they were associated, in advancing the interests of the industry, and in engendering good fellowship. The frank confidence that existed between the members and the Council was recently exemplified when new proposals were laid before the members. He wished he could speak in the same vein of the industry of the country; a great change had come over it since the armistice. An immense accumulation of purchasing power, augmented by credits advanced by the banks, was then set free, and an orgy of spending set in, with the result that the purchasing power soon left this country, credits were locked up, taxation reached an unexampled intensity, deposits were exhausted, and the banks began to call in credits. The nation had been spending more than its total income, and more than its total production, and it was brought up with a round turn. Most of the people were insisting on living on a higher scale than before the war, or alternatively on receiving money which they had not earned. The electrical industry lived on new construction, not on the replacement of past construction. Before the war the country saved 300 millions a year—now he doubted whether it saved 100 millions; it needed 20 millions a year put into new electrical construction—where was the money to come from? The only possible source was America; much American money was being spent here now, in the belief that the exchange would improve, and that might pull us through. The reorganisation of the electrical industry contemplated during the war, and embodied in an Act in 1919, amounted to a quasi-nationalisation; the Institution held that it would be sufficient to appoint Commissioners and let the existing organisations work out their own expansion. The Commissioners had been at work for nearly a year, and had been considering proposed schemes, but these had proved disappointing; they would not carry conviction to the minds of engineers or financiers, and it was further disappointing to find that the old struggle between companies and municipalities had begun again. He sounded a note of warning: the public had made up its mind to have a large and efficient electrical distribution; under the Commissioners the electrical engineers had the opportunity of doing the work themselves—but if they did not succeed, the public would come in and do it, and the public would then have the support of the manufacturing and employés' interests, as the only way to get a move on. A campaign had already begun in the financial and other papers, belittling the work of the Commissioners; the Institution did not support that campaign—the Commissioners knew their business, and there was no fear that they would lack ability—but he feared the inefficiency of the schemes put before them. The members must face these difficulties and use their individual influence to overcome them.

Mr. A. A. Campbell Swinton proposed "Our Guests," remarking that there were no politicians among them this year, but that was not a matter to worry over; electrical engineers thought more of people who did things than of people who only talked about doing them.

Sir Frank Heath, in responding, said that the impression that he had formed of the Institution of Electrical Engineers was that it had a capacity for long-sighted statesmanship equalled by no other society. Mr. Wordingham's scheme for a National Proving House would sooner or later be realised. Among the 26 Research Associations which had come into existence, not one had provided for the representation of the scientific man to the same extent as the Electrical Research Association.

Sir John Bland-Sutton also responded, referring to the conspicuous services which electrical science had rendered to his profession, and reviewing the wonderful progress made during a lifetime.

The company then adjourned to the reception room, where old friendships were renewed and new ones begun, and conversation was kept up till a late hour. During the evening a programme of music was performed by the Imperial Orchestra, and the arrangements were all very satisfactory.

REVIEWS.

Industrial Electric Vehicles and Trucks. By W. Worby Beaumont, M.Inst.C.E., &c. Pp. xii + 183; 189 figs. London: Charles Griffin & Co., Ltd. Price 15s. net.

In view of the rapidly increasing importance of the industrial electric vehicle, both indoor and outdoor, this book comes at an opportune moment. The author has for many years been an authority on automobilism, and though he has latterly appeared to champion the cause of the petrol-driven type of vehicle, his heart has been in the right place all the time, for, as he points out, as long ago as 1902 he wrote: "Given the electricity supply, nothing would be better than the electric motor for the propulsion of vehicles." That supply is now available, the electrical method of propulsion with secondary batteries has been proved to be "a practical commercial proposition," and experience has shown, he says, that in many fields the electric vehicle may be more convenient and profitable than any other type. We heartily agree; but much still remains to be done in providing charging stations and garage accommodation, before the "electric" will be able to achieve the position to which it is justly entitled.

In the work before us the author first sets forth particulars regarding the construction and operation of the various industrial vehicles that are on the market in this country, with numerous illustrations of vans and wagons, lorries, chassis, driving gear, controllers, and other components. A chapter follows on industrial trucks, of which he speaks in terms of highest commendation; we need not say "industrial electric trucks," because there are no other automobile trucks fit to be used inside factories and workshops, in railway stations, works' yards, &c. In this sphere electricity is supreme, not only because unique, but also because so singularly well adapted to the purpose. Next the author deals with the components—the motor, which he regards as "a beautifully adapted electromechanical instrument"; the batteries, of which the field of choice is very limited; and the controllers, after which he turns to battery-charging equipments, motor-generators, and plugs and sockets. The concluding chapters give costs of working, as published by various municipal and private users, and some notes on rubber tires.

It will be seen that the book is almost wholly descriptive; criticism is practically absent, and the author—or should we say compiler?—has modestly refrained from expressing his own opinions, except on certain subjects, such as the power required for traction, and the choice of tires, in connection with which he has carried out tests. For the bulk of the information contained in the book the manufacturers, the Electric Vehicle Committee, and similar sources are obviously responsible. This is not to say, however, that the book lacks utility; far from it. Here will be found abundance of facts and figures, from which the reader may draw his own conclusions, and in justice to the author, it should be said that he claims no more for it. The illustrations are generally good, and the text is well printed on good paper. We have found few misprints, though we may say that the illustration of the Tirrill regulator on p. 131 is upside down, and the title of *The Electric Vehicle* is mis-spelt in a few places. In the next edition some space should be given to the mercury arc rectifier, which is only named once in this volume, we believe. We know of no other work covering the field dealt with in this book, which therefore is sure to be widely read.

Problems in Physical Chemistry, with Practical Applications. By Edmund B. R. Prideaux, M.A., D.Sc., F.I.C. Second edition, Revised. Pp. xii+294. London: Constable & Co. 1920. Price 18s. net.

The only way to obtain a real working grasp of any branch of physical science or engineering is to reduce it ultimately to arithmetic. The application of physical chemistry to the solution of industrial problems is of recent date, and it is gratifying to welcome a second edition of this useful book—the first edition appeared in 1912—for it shows that physical chemistry is coming to its own. The problems stated include thermochemical reactions, the properties of one and two component systems, reactions in gases and in solutions, electrochemical reactions, and the kinetics of molecular and radioactive changes. Some of the examples chosen are highly suggestive of the increasing part physical chemistry is destined to play in industry. It seems likely that soon no engineer who has to deal with power production will be regarded as being completely equipped if he has not some knowledge of the fundamentals of this science.

A Large E.H.P. Insulator Order.—The *Electrical World* says that an order for 45 000 units of suspension-type insulators has been received by the Locke Insulator Manufacturing Co., Victor, N.Y., from the Southern California Edison Co., Los Angeles. They will be used on an experimental section of transmission line approximately 20 miles in length for operation at 220,000 volts. The Southern California Edison Co. is at present operating at 150,000 volts with nine suspension insulator units per string.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Inclinable Power Press.

Regent Shears, Ltd., of Wakefield, have sent us particualrs of an improved type of inclinable power press for the production of all classes of sheet metal stampings, and particularly electrical stampings, which they have recently put on the market. The machine is illustrated in fig. 1, and it will be seen that the beam has slides of broad and long proportions ensuring the utmost rigidity during operation. The coupling is very robust, and a new type of tilting gear has been embodied in the design. Among the special features are the

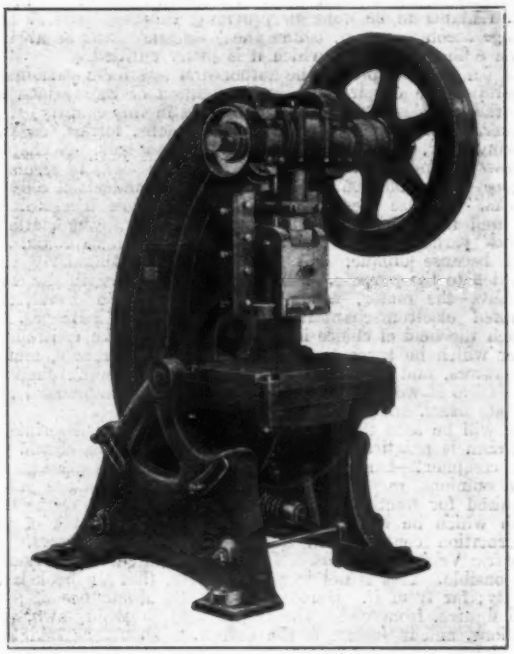


Fig. 1.—An Inclinable Power Press.

"Regent" patent safety clutch motion and automatic mechanical brake. The clutch is foot-operated, depression of a lever allowing one stroke by releasing a key to engage with the flywheel. The withdrawal of a pin enables the press to operate continuously while the foot lever is depressed. The brake has been designed with a view to reducing the power required for driving the machine during periods when the braking action is not necessary. By its means brake friction is reduced to a minimum, giving reduced power consumption.

A Suspended Rivet Heater.

A very useful form of electric rivet heater has been placed on the market by the A.I. Manufacturing Co., Industry Works, Sunbridge Road, Bradford. The apparatus is made suitable for suspension from an overhead runway or crane hook, which gives great portability in cases where work is distributed throughout the length of a shop or factory. The transformer is fixed to a counter-balanced bar suspended by its centre from a hook. Its primary is generally wound for a.c., 50 cycles, 230 V, and it is provided with a change-over plug switch giving five different degrees of heat. The connections to the electrodes are of ample length and insulated from one another. The electrodes consist of 1¼ in. diameter solid hard-drawn copper fitted into round grip sockets and provided with hard wood handles.

In operation the heater is brought up to the work, and the rivet is placed in position to complete the circuit. When the rivet has reached the proper state the electrodes are opened, and the machine, controlled by the balance weight, is brought into position for the next "heat."

As regards the performance of the machine, it is said that 500 3/16 in. diameter mild steel rivets can be heated per hour, or 180 ½ in. diameter rivets in the same time.

All parts of the apparatus are well protected, and it is claimed to be practically "fool-proof."

The Blackman Stream-line Fan.

The endeavour to secure an improvement in the efficiency of propeller fan blades by making them with a section approximating the most efficient stream line, has resulted in the production of a fan giving, it is claimed, 30 per cent. higher mechanical efficiency than the next best of its class, by the Blackman Export Co., Ltd., 374, Euston Road, N.W. 1. The new fan is illustrated in fig. 2. Each of its six blades is hollow, both sides being convex with central internal stays for holding them to the boss of the wheel. There are no projections, the whole blade offering the minimum resistance

Fig. 2.—The Blackman Stream-line Fan.

to the air flow. The fan is reversible, and can be run in either direction with equal results. The blades are separately renewable without dismantling or even dismounting the whole fan. This offers great facility for shipping, as the blades can be packed in a very small space.

The "Powerlight" Set.

A very compact small lighting and power set is made by the Hamworthy Engineering Co., Ltd., 76, Victoria Street, S.W. 1. This is known as the "Powerlight" set, and is illustrated in fig. 3. As will be seen from the illustration, the dynamo is mounted above the engine, leaving the latter free to perform other duties if required. The engine can be run on petrol or paraffin, and develops 2½, 3½, or 6 b.h.p. according to size. The dynamo is of the open protected type, shunt wound, and fitted with ball bearings. The drive is effected by a leather link belt which is very flexible. The switch-

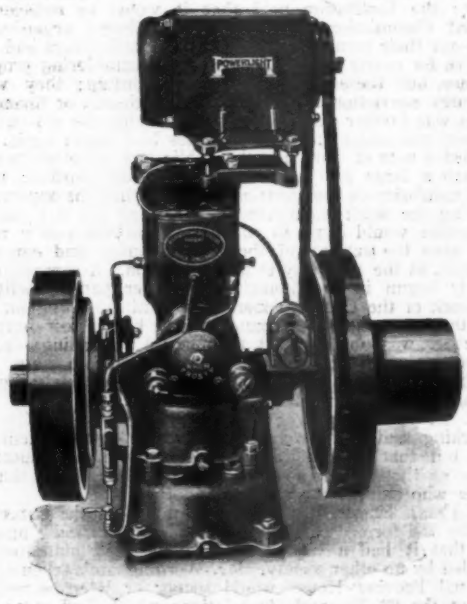


Fig. 3.—The "Powerlight" Set.

board consists of an aluminium panel upon which are mounted the control switch, an ampere-hour meter, two switch fuses, and an engine stop button. The set can be started by bringing the control switch into the starting position, and then to the "on" position, where it will remain until the battery is fully charged, when it automatically cuts the battery out. The battery consists of 14 cells with a capacity of 60 Ah when discharged at a 10-hour rate at 1.85 volts per cell. It is complete with all accessories.

TEMPERATURE LIMITS OF LARGE ALTERNATORS.

Discussion at Newcastle-on-Tyne.

At a meeting of the members of the North-Eastern Centre of the Institution of Electrical Engineers, held at Newcastle-on-Tyne, on February 14th, Mr. G. A. Juhlin's paper on "Temperature Limits of Large Alternators," which was abstracted in our issues of February 4th and 11th, was read and discussed.

Mr. E. Fawssett, who opened the discussion, said that both manufacturer and user had much to gain by adopting methods of ascertaining temperature which would tell them what was taking place. The author stated that the sources of heat were well known, but heat was found in quite unusual places, such as were only discovered by actual practice, and he felt that it was that sort of fact which would account for the conservative limits of heating usually laid down, and although it was quite realised that insulation would stand those hot spots, yet it was necessary to allow a margin to cover any unexpected temperatures that might be experienced. As to measuring the temperature of the stator by the resistance test, that method took considerable time, and he thought the only way to get a reasonable idea of what the conditions were was to plot a time curve backwards, which would give a fairly good idea of what the temperature was when they shut down. The thermo-couple as described by the author was, in the speaker's experience, quite good enough. They started using it years ago on large machines, and found the apparatus very valuable; the thermo-couple was quite sufficient and was extremely accurate. Manufacturers should study temperature limits just as they did steam consumption.

Mr. T. Carter pointed out that there did not seem to be any allowance for overload, yet it was an important point. They should know how the machine they were using stood with regard to that matter before they used it, and not have to find out afterwards. He drew attention to the statement: "The limits for the temperature rise laid down by the British Engineering Standards Association for fibrous insulation are 55 deg. C. measured by resistance or 50 deg. C. by thermometer," and said he could not understand how they could measure 55 deg. by resistance and 50 deg. by the thermometer—nor had he found anyone who could explain it.

Mr. J. M. Waite gave some figures of resistance tests showing the great variability as compared with thermometer tests. A thermo-couple was put where they expected a hot spot, and when the machine was running they got a reading showing 84 deg. C.; the load was taken off, the plant shut down, and they got a temperature of 93.11 deg. The fact was that the thermo-couple had not been shielded from the air-blast. On the rotor where they could not get a reading by thermometer they measured it by resistance, and got 124 deg. C. when standing and 85 while running. He claimed that the instrument used for ascertaining the temperature, whatever it was, should be as simple as possible; what they wanted in all those matters was reliable relative accuracy. If they knew the margin of safety there might possibly be a saving in constantly running an alternator at a higher temperature; if it could be run at a little overload safely there might be a distinct saving.

Mr. C. H. Davidson explained that they worked machines in America at a much higher temperature than was usual in this country, and manufacturers would have to consider adopting higher temperatures, or they would find the markets closed to them. He thought the 40 deg. rise too low, and that the B.E.S.A. limits were too much on the safe side. It was a little disquieting to hear so much about hot spots, he had been working to get rid of them, and in some designs of machines they got an even temperature all through. As to the bar test mentioned, some attempt should have been made to imitate the vibration the bars were subjected to in a machine. Respecting the use of mica insulation, all the author's references were to the mica, whereas they should give more attention to the material that held the mica together—the fibre or fabric, or whatever it was—because the real difficulty did not lie with the mica, but with the other material, the life of which determined the life of the insulation. He also pointed out that the temperature limits were practically the same as recommended by the Conference held at Berlin some eight years ago.

Mr. R. M. Longman said the increase in the size of machines had made it more difficult to get at the hot spots. Regarding the difference between the 6,000 and the 11,000-volt machine, the speaker rather favoured the 11,000-volt one; they had the extra insulation and the B.E.S.A. only allowed 9 deg. difference in temperature.

Discussion at Birmingham.

At Birmingham Mr. Juhlin's paper was discussed before the South-Midland Centre of the Institution of Electrical Engineers on February 2nd.

In opening the discussion, Dr. G. Kapp said that in his opinion the most important matter was not to get cheaper but safer machines, and safer machines involved an exact knowledge of the heating conditions. He could not agree that the use of a thermometer was the simplest and easiest method; moreover, it was misleading. It was essential to know the actual temperature at the hot-spot, and to get that required a detector placed actually at the hot-spot. The speaker then discussed in detail the difficulties of accurate hot-spot temperature measurement. A null method suggested by him consisted in using in the outside circuit a couple of the same materials as that embedded in the machine at the hot spot. The outside couple was immersed in a liquid which could be heated until a galvanometer gave a zero reading. The outside couple was then at the same temperature as the embedded couple, and its temperature could be accurately measured.

Major A. M. Taylor suggested a method of deducing the hot-spot temperature indirectly from observations on, first, the increase of resistance of the whole circuit due to the combined action of the normal part and the hot-spot part, and then the increase of resistance in the complete circuit when the hot spot was not active (as, for example, when the stator was cool). To carry out the suggestion it was necessary to know the proportion of the length of the circuit covered by the hot spot.

Mr. A. T. Bartlett said that the use of temperature detectors was the only sane way of running plant. For instance, in the case of a power house, if a set was started up cold and the steam end was capable of dealing with a certain overload, the generator could also be overloaded for a time if the detector showed that the safe temperature was not exceeded. In his opinion ascertaining temperatures by balancing methods was wrong; the power house attendant already had enough to do, and all detector instruments should be of the inspectional type.

Mr. W. J. Line thought that it appeared to follow from the mechanical tests described by the author that breakdown under high voltage might be expected to occur at the same place as mechanical breakdown, namely, where the insulated conductor left the slot. He believed it was a fact that breakdowns did occur more frequently at that point than elsewhere, but he questioned whether it could be inferred that electrical failures occurred where mechanical failures occurred due to bending of the insulated conductor at its point of emergence from the slot. In connection with the results of some dielectric and other tests made some years ago by Wilson and Mitchell it was suggested that as the density of the dielectric force at the ends of the slots in which the coils were embedded was considerably increased, the ends of the slots should be rounded, and that suggestion seemed worthy of consideration.

Dr. M. Kahn favoured gradual development rather than an immediate increase of temperature limits. All firms building large units and many operating engineers were alive to the question and data, and experience were continuously increasing. The problem was not an urgent one, as it was quite possible to produce the sizes at present required within the limits of a total working temperature of 120 deg. C. Manufacturing and operating engineers who had to rely on those sets for a large proportion of the load had no interest in running risks. The accumulation of experience would naturally tend to lead to development up to a safe limit in course of time. A point not mentioned by Mr. Juhlin which might conceivably determine the safe temperature limit was the expansion of the long coils in large machines.

A New Kinematograph Projector. — According to *Nature* of February 24th, a kinematograph projector of a new type was demonstrated by Mr. R. J. Trump at the Imperial College, South Kensington, on February 10th. The invention of Mr. Kingsley-Higginson, it employs, in place of the shutter and intermittent film-feeding gear of the ordinary machine, a continuously rotating ring of mirrors to stabilise the image and effect the change of picture while the film is run uniformly through the machine. The beam of light is thus always passing unobstructed to the screen, and the alternations of light and darkness produced by the shutter, which constitute the flicker of the ordinary projector, are avoided. The new apparatus can be run quite slowly if required, and in any case there is no necessity to speed it up in the way that is at present usual. The change of picture takes place zone by zone across the screen, which always shows a full image, derived from parts of two successive pictures on the film. The facets on the ring of mirrors are so arranged and set at such an angle that the two lights from the two partial film-pictures which are present at any instant in the gate are separated and transposed into their correct positions on the screen, and joint up to form a complete image. There is no dark period and no overlapping or dissolving of the successive pictures into each other, as the first picture disappears at precisely the same rate that the second takes its place. A good and sharply defined image is obtained. The advantages of a uniform feed for the film are considerable, in that the wear and tear upon it are much reduced, and the risk of breakage is negligible. The application of the same principles to kinemaphotography is under consideration, and there is every expectation that useful results will be obtained.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

5,359/61. "Insulation for armatures." J. F. Cullin. February 16th.
5,360. "Wrapping machine." J. F. Cullin. February 16th.
5,362. "Machine for positioning armature windings." J. F. Cullin. February 16th.
5,363. "Armature winding." J. F. Cullin. February 16th.
5,364. "Coil winder." J. F. Cullin. February 16th.
5,365. "Armature winding testing mechanism." J. F. Cullin. February 16th.
5,374. "Electric light fitting." J. Y. Fletcher and C. W. Saunders. February 16th.
5,382. "Electric insulators." Metallurgique Electrique. February 16th. (France, September 27th, 1920.)
5,393. "Electric accumulators." G. W. Richards. February 16th.
5,394. "Electric measuring instruments of the hot wire type." A. Lederer. February 16th. (Austria, February 25th, 1920.)
5,398. "Sparking plugs, &c." L. Febbraro and J. Narizzano. February 16th.
5,404. "Sparking plugs." W. Brägger. February 16th
5,411. "Electric motor controllers." G. N. Cadbury. February 16th.
5,412. "Electrical locking device for vehicle doors." A. J. Cordell. February 17th.
5,432/9. "Fittings for gas or electric light." T. J. Saveker. February 17th.
5,436. "Electrical transmission systems." A. M. Taylor. February 17th.
5,456. "Wireless, &c., signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. February 17th.
5,459. "Commutators." J. E. Calverley and W. E. Highfield. February 17th.
5,460. "Electrical insulating members." J. E. Calverley and W. E. Highfield. February 17th.
5,465. "Vent plugs for electric accumulators, &c." A. L. Davis. February 17th.
5,467. "Interrupters." E. E. Greville and F. W. Read. February 17th.
5,468. "Electro-medical apparatus." E. E. Greville and F. W. Read. February 17th.
5,490. "Electric signalling." B. Davies and Eastern Telegraph Co., Ltd. February 17th.
5,491. "Electric cables or conductors." J. Drennan. February 17th.
5,500. "Dentures." J. Lavine. February 17th.
5,504. "Electric hand lamps." J. Lewington and T. W. Lewington. February 17th.
5,521. "Automatic electric couplings." A. V. Tomlinson (Westinghouse Air Brake Co.) and Westinghouse Air Brake Co. February 17th.
5,524. "Electromagnet switches for controlling circuits of train lighting, &c., installations." A. H. Darker and J. Stone & Co., Ltd. February 17th.
5,553. "Device for preventing vibration destroying the filaments in electric globes." A. McArthur. February 18th.
5,557. "Securing wires, cables, &c., for ignition magnetos, &c." F. H. Farrer, F. Pountney, and Villiers Engineering Co., Ltd. February 18th.
5,614. "Electrically heated muffle furnaces." Akt.-Ges. Brown, Boveri et Cie. February 18th. (Switzerland, February 18th, 1920.)
5,619. "Sparking plugs." C. S. Harrison. February 18th.
5,620. "Electrically operated rotary advertising devices, &c." J. M. Robertson. February 18th.
5,621. "Electric discharge tubes." Naamlooze Vennootschap Philip Glocilampenfabrieken. February 18th. (Holland, April 20th, 1920.)
5,627. "Electro-mechanical pocket lamp." Soc. Blot-Garnier et Chevalier. February 18th. (France, July 24th, 1920.)
5,628. "Combined switch and plug for electric circuits." J. R. Middleton and Watts, Williams & Co., Ltd. February 18th.
5,629. "Dimming electric lights." J. R. Middleton and Watts, Williams and Co., Ltd. February 18th.
5,630. "Magneto generators." J. R. Middleton and Watts, Williams and Co., Ltd. February 18th.
5,643. "Insulators for suspended high-tension electric wires." A. Renaudin. February 18th. (France, February 23rd, 1920.)
5,648. "Recording electric currents." J. H. Jones and L. Kecskemeti. February 18th.
5,655. "Electrical apparatus for railway signalling." F. Downs and Tyer and Co., Ltd. February 18th.
5,671. "Electric switches." H. B. Cornish. February 19th.
5,674. "Charging boards for electric accumulators." C. E. P. Gabriel. February 19th.
5,708/9. "Dynamo-electric machines." C. P. Bramley, Lancashire Dynamo and Motor Co., Ltd., and W. Stansfield. February 19th.
5,713. "Trolley wheels for poles of electric tramcars, &c." E. Nightingale. February 19th.
5,730. "Automatic cut-out and indicating apparatus for electrical accumulators." C. E. Cox and White Electrical Instrument Co., Ltd. February 19th.
5,743. "Wireless receiving apparatus." British Thomson-Houston Co., Ltd., and R. C. Clinker. February 19th.
5,754. "Casings for electric pocket lamps." B. Rogge. February 19th. (Germany, March 24th, 1920.)
5,755. "Electric meters." Chamberlain & Hookham, Ltd., and S. James. February 19th.
5,757. "Automatic switches." J. Bogopolsky. February 19th.
5,783. "Permanent way of tramways." D. McDonald. February 21st.
5,803. "Electric drilling-machine." W. Bairstow. February 21st.
5,807. "Radio signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. February 21st.
5,810. "Duplex, &c., telegraphic systems." H. W. Sullivan. February 21st.
5,828. "Portable dynamos for electric lighting sets." H. Humphrey. February 21st.
5,837. "Sparking plugs." A. E. Heath. February 21st.
5,847. "Hand-operated mechanism for operating electric controllers, &c." A. West and West & Co., Ltd. February 21st.
5,849. "Electric control systems." British Thomson-Houston Co., Ltd., and General Electric Co. February 21st.
5,855. "Electric heating devices." P. M. A. Mounier. February 21st. (France, February 19th, 1920.)
5,857. "Wall-plug connections for electric circuits." J. Hall & Co. and G. F. Ostins. February 21st.
5,887. "Cable tips." F. Forg. February 21st. (Germany, July 21st, 1920.)
5,894. "Thermionic valve transmitters." Ges. fur Drahtlose Telegraphie. February 21st. (Germany, February 28th, 1920.)
5,916. "Conduits, tubing, connections, bends, &c., for electric light wiring, &c." T. Hayward. February 22nd.
5,920. "Adaptor for sparking plugs." A. M. Porter. February 22nd.
5,947. "Lathe attachment for re-surfacing commutators." W. E. Irons. February 22nd.
5,956. "Signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 22nd.
5,971. "Sparking plug." H. S. H. Hughes and J. W. Hughes. February 22nd.
6,009. "Coupling-rod drive of driving axles of electrically-driven vehicles." E. C. R. Marks and Western Electric Co. (Akt.-Ges. Brown, Boveri et Cie.). February 22nd.
6,011. "Electric furnaces." A. E. Reid. February 22nd.
6,013. "Thermal ammeters." Weston Electrical Instrument Co. February 22nd. (United States, March 24th, 1920.)
6,021. "Means for indicating failure of filament in one of a number of incandescent lamps." M. Latour. February 22nd. (France, March 18th, 1920.)
6,040. "Appliance for indicating location of faults in section feeder-boxes of overhead-wire systems of electric tractions." Brecknell, Munro & Rogers, Ltd., and F. W. Brecknell. February 22nd.
6,058. "Emergency electric signalling-device for warning locomotive driver." W. Boller. February 23rd.
6,059. "Tumbler switch." M. Munday. February 23rd.
6,078. "Electric circuit-breaker." S. Jones. February 23rd.
6,110. "Electric switch." T. W. Rogers (F. Krupp Akt.-Ges.). February 23rd.
6,119. "Lighting devices for motor vehicles, &c." Benjamin Electric, Ltd. February 23rd. (United States, October 27th, 1920.)
6,121. "Protective apparatus for dynamo-electric machines." G. A. Juhlin & J. A. Kuyser and Metropolitan-Vickers Electrical Co. February 23rd.
6,134. "Electric terminals." W. H. Egginton and H. Lucas. February 23rd.
6,137. "Electric storage-battery or accumulator cells." Chloride Electrical Storage Co., Ltd., and B. Heap. February 23rd.
6,138. "Secondary electric batteries or accumulators." Chloride Electrical Storage Co., Ltd., and B. Heap. February 23rd.
6,141. "Electric lamp." E. de Lorenzi. February 23rd.
6,146. "Electric motors." British Thomson-Houston Co., Ltd. (General Electric Co.) and General Electric Co. February 23rd.
6,153. "Thermionic steam-reducing valves." Steam Fittings Co., Ltd., and B. R. Wingfield. February 23rd.
6,156. "Electric fittings." N. W. Scaife. February 23rd.
6,158. "Alternating-current circuits comprising condensers." E. W. Dorey. February 23rd.
6,161. "Means for actuating repeater signals on locomotives of electric railways." J. Bethenod. February 23rd. (France, February 24th, 1920.)
6,167. "Arrangement for transmission of energy by resistance coupling." S. Loewe. February 23rd. (Germany, February 23rd, 1920.)
6,168. "Apparatus for testing electric resistance of fluid materials, &c." V. Planer. February 23rd. (Germany, May 17th, 1920.)
6,189. "Arrangements for operating tools, &c." Automatic Telephone Manufacturing Co., Ltd. February 24th.
6,201. "Switches for electric irons." A. G. Bullen and R. L. Jenkinson. February 24th.
6,205. "Electrically-operated reciprocating tools, &c." T. F. Wall. February 24th.
6,225. "One-way transmission gear for train-lighting apparatus, &c." L. C. H. Mensing. February 24th.
6,229. "Manufacture of telephone receiver cases." S. O. Cowper-Coles. February 24th.
6,240. "Electric driving equipment for reversing machine tools." H. T. Millar. February 24th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

9,364. "Electro-magnetic wave navigational systems." M. Jeance. April 12th, 1919. (158,284.)
20,398. "Wireless telegraph transmitters." H. J. Round and W. T. Ditchen. August 19th, 1919. (158,291.)
26,470. "Process for recovering selenium and noble metals from electrolytic slimes and the like." M. Chikashige and D. Uno. October 28th, 1918. (158,330.)
26,621. "Installations for electrically lighting, heating, and ventilating railway carriages and other vehicles." H. D. Rohman. October 29th, 1919. (Addition to 145,120.) (158,328.)
29,[illegible]21. "Controllers for electric motors." British Thomson-Houston Co., Ltd. (General Electric Co.). October 30th, 1919. (158,334.)
27,039. "Means for supporting antennæ used in wireless telegraphy." R. St. George-Moore and G. S. Whitmore. November 3rd, 1919. (158,353.)
27,083. "System of distant control without additional line wires for electric supply systems." W. Joice. November 4th, 1919. (158,357.)
27,143. "Electric power-generating units." E. L. Russell. November 4th, 1919. (158,361.)
27,151. "Electric resistance units." British Thomson-Houston Co., Ltd. (General Electric Co.). November 4th, 1919. (158,353.)
27,222. Alternating current electric motors." W. E. M. Ayres and Metropolitan-Vickers Electrical Co., Ltd. November 5th, 1919. (158,372.)
27,[illegible]. "[illegible] switches." R. H. Baker and C. W. Parsons. November 6th, 1919. (158,377.)
27,[illegible]. "Electric arc lamps or projectors and carbons or electrodes therefor." C. B. Burdon (Siemens Schukertwerke Ges.). November 6th, 1919. (158,380.)
27,431. "Electric circuit-breakers, particularly for the electric-ignition systems of internal-combustion engines." N. C. F. Jensen and M. J. E. Tilney. November 6th, 1919. (158,385.)
27,463. "Cable connectors for use with electric motor lamps and other purposes." C. A. Miller, F. J. Miller and E. A. Sanders. November 7th, 1919. (158,386.)
27,721. "Frequency meters." Nalder Bros. and Thompson, Ltd., and C. L. Lipman. November 10th, 1919. (158,393.)
27,922. "Electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). November 11th, 1919. (158,396.)
28,518. "Phonic motor drive for telegraph machines." D. Murray. November 18th, 1919. (158,413.)
28,712. "Portable electric lamps or torches." H. M. Koretzky. November 19th, 1919. (158,415.)
28,975. "Magneto-electric machines." British Thomson-Houston Co., Ltd., H. W. H. Warren and A. P. Young. November 21st, 1919. (158,419.)
29,683. "Electric motors." T. Zweigbergk. November 28th, 1919. (158,436.)
30,266. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 10th, 1919. (140,053.)
32,164. "Electrical heater for wells." D. Diver. December 23rd, 1919. (158,452.)

1920.

347. "Wireless telegraphy and telephony receiving instruments." H. P. Rees. January 5th, 1920. (Cognate application 2,005/20.) (158,455.)
730. "Electrical circuit-breaker." R. Simpson. January 9th, 1920. (158,457.)
1,659. "Electric discharge devices." British Thomson-Houston Co., Ltd. January 19th, 1920. (158,458.)
2,461. "Electric pocket lamps." E. Blondy. February 20th, 1919. (143,190.)
4,239. "Measured service devices for use in telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 12th, 1919. (138,914.)
4,829. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 11th, 1919. (141,674.)
5,429. "Electric fusible cut-outs having replacement devices." P. Davies. February 23rd, 1920. (158,462.)
8,341. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 30th, 1919. (146,062.)
8,444. "Electric furnaces." Soc. Metallurgique Du Frayol. January 7th, 1920. (157,051.)
12,372. "Electric crucible furnaces." C. Soncini. April 25th, 1919. (142,836.)
13,793. "Magnetos." D. V. L. Fellows. May 19th, 1920. (158,486.)
15,347. "Electric lamps with luminous discharge." British Thomson-Houston Co., Ltd. (General Electric Co.) June 6th, 1914. (Divided application on 13,759, 1914.) (158,488.)